MASSACHUSETTS AGRICULTURE.

BULLETIN NO. 1. SEPTEMBER, 1917.

FIFTH EDITION, REVISED.

POULTRY CULTURE.

ISSUED BY THE
MASSACHUSETTS STATE BOARD OF AGRICULTURE, STATE HOUSE, BOSTON.
WILFRID WHEELER, SECRETARY.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1917.

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PUBLICATION OF THIS DOCUMENT
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SUPERVISOR OF ADMINISTRATION.

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Typical Massachusetts poultry farms.

OPPORTUNITIES IN POULTRY CULTURE IN MASSACHUSETTS.[1]

JOHN C. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASSACHUSETTS.

INTRODUCTION.

The rapid growth of our cities and towns during the last few decades, partially at the expense of rural population, has caused congested city conditions, an increased price of agricultural products, and, in general, has aided materially in bringing about the high cost of living. As one would naturally expect, these conditions have turned the attention of all classes of city people toward the farm, so that at the present time "back to the soil" is heard in the city nearly as often as "young man, go west" was heard several years ago. The former expression sounds very alluring to city-bred people who read of the opportunities in various lines of agriculture, — how abandoned farms can easily and readily be restored to their former state of production; what wonderful crops can be produced when handled by the "right man;" and many other similar flowery and attractive stories.

To be sure, the advantages of rural life over those of the city are enticing. Life on the farm now is not what it was a few years ago. The farmhouse, with all its modern conveniences, pure air, healthful work and more or less independent life draw many from the city, and we hope it will continue to do so. But let us impress upon the inexperienced that to-day any one of the various lines of specialized agriculture is much more of a business proposition than is general farming under less intensive conditions, and one who embarks in any branch of it with the hope of success should at least be well versed in the rudiments of the business. The fact alone that agricultural colleges and experiment stations have been established in practically all the States of the Union — to train men and women for agricultural pursuits and to help farmers solve their problems — is evidence that those who contemplate engaging in any line of farming should be well informed on the subject. The following pages give but a mere outline of the opportunities in poultry culture in this State, with special emphasis laid upon the necessity of preparation for the industry.

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[1] This article was prepared to accompany the Massachusetts exhibit at the Panama-Pacific Exposition.

PRODUCTION AND CONSUMPTION.

A great deal has been said in recent years about the consumption and production of poultry products in Massachusetts. From statistics gathered a few years ago on this subject the production was estimated at from $6,000,000 to $7,000,000, and consumption, $25,000,000 to $30,000,000. Students of economics believe the latter figures to be far too low, and those acquainted with the productive side believe the former do not give credit to the industry. A careful survey of the city of Ithaca, New York, in 1914 showed that the average annual consumption of eggs per capita was 400 and the number of chickens and fowls 8. Granting that the people of this State eat as many eggs and poultry per capita as those of Ithaca, the total value of products consumed would reach the enormous sum of $60,000,000 or over. The data obtained in Ithaca correspond very closely with those obtained in New York City in determining the value of poultry and eggs consumed there. We cannot be far from correct then when we say that the value of these products consumed in Massachusetts annually is in the neighborhood of $45,000,000 to $50,000,000, and there is abundant evidence that the production of eggs and poultry in this State is rapidly increasing. The baby chick industry has enabled hundreds of people to buy and raise a few chicks in back yards who have not been able to do so heretofore because of lack of facilities for hatching or obtaining chicks. I believe, when statistics are gathered showing the number of chicks hatched in Massachusetts annually, the figures will be astounding. The important point for the man to note who intends to embark in the poultry business or increase his output is the fact that as long as consumption in the State is several times greater than the production there is no immediate danger of the business being overdone.

CLIMATE.

The climate in this State is very favorable to poultry culture, for we do not have the extremely cold spells in winter nor the prolonged hot ones in summer which are found in the more central portions of our country. At first thought, one might suppose that a section of the country having warm winters or, in other words, perpetual summer is better suited for poultry than ours, but in reality it is found that under such conditions more work is required to keep down disease and such pests as lice and mites than to care for the poultry. Long, mild autumns and snow not remaining on the ground usually before the last of December are factors which are conducive to finishing off the pullets and bringing them to laying maturity before real winter sets in.

The winter of 1913–14 was considered one of the coldest in years, yet poultry were kept in open-front houses without freezing their combs, and in general the egg production was excellent. On many farms production was above the average. In some sections of the country many hens are lost during the summer on account of excessive heat. Such losses are comparatively few in Massachusetts, however, as the nights are always cool. This climatic condition not only adds to the comfort of the fowls, but is conducive to high summer laying.

Another point not to be overlooked is the fact that the greater part of this State is free from fogs as compared with some sections of our country having a more moderate climate. We are fortunate in this respect, as fogs cause heavy dews in spring and summer, decrease the sunshiny days in winter and dampen the poultry houses at that season of the year. In some States near the coast poultrymen are often obliged to keep their cloth screens closed in order to shut out the fog and mist. On account of the moderate climate, in the eastern part of the State especially, the early hatching and rearing of chicks is encouraged. The result is the production of early broilers, early roasters and early pullets for fall layers when eggs are extremely high, thus insuring high prices throughout the season. Again, on account of the mild climate, the winter growing of chickens has become an important industry, and the "South Shore Roaster District" is known throughout the world. Winter growing enables the producers to put fine, large roasters (capons) on the market from March to July, when the cold-storage plants are practically empty. In other words they control the market, and the prices (live weight) range from 25 to 33 cents per pound.

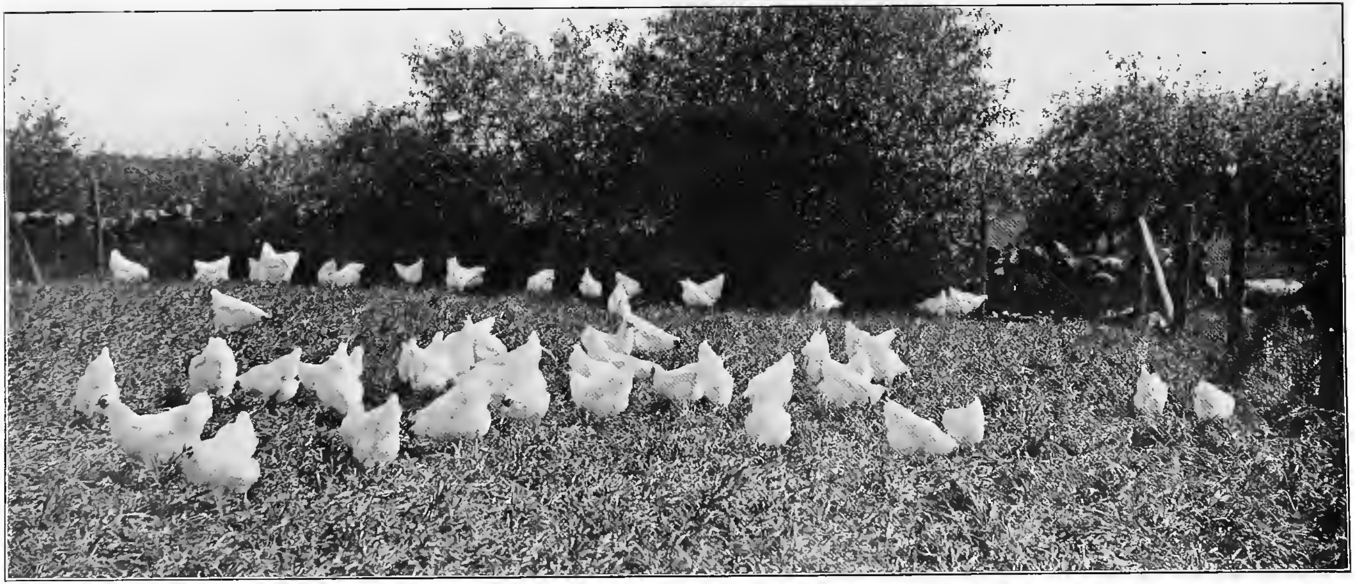
Soil.

In no section of the country is soil better adapted to poultry. Most parts of the State have a light, sandy or gravelly loam. There is no danger, therefore, of its becoming contaminated with droppings, as it is leached out by the heavy rains. On such farms in New England poultry have been kept on the same land for forty years with no serious results. Of course, I refer now especially to poultry farms, not general farms where only a few fowls are kept, and to the extensive rather than the intensive system. Again, much of the soil here is adapted to the growth of corn, mangels, beets and all kinds of green crops for poultry. Its sandy condition gives a quick growth which means tender, palatable green food throughout the growing season.

The fact that our soil and climate are well adapted to all kinds of fruit is an advantage that cannot be overlooked. Fruit trees not only yield a crop, but furnish shade in summer and windbreaks in winter. Much of the soil is well suited to the production of corn, and immense crops can be produced by raising corn and poultry on the same ground in alternate years. Very little fertilizer other than that produced by the poultry need be used, other things being equal.

Low Price of Land.

We are sure very few people living in New England realize the difference in the cost of land here as compared with that in the middle west. Very little farm land can be bought there for less than $100 per acre, and most of it sells for $125 to $160,



White Plymouth Rocks in rye field.

if the location is at all favorable. On the other hand, good land for raising poultry can be bought here for $25 to $50 per acre. The advertising columns of any of our Sunday papers bear testimony to this statement. The cheap land in this State is not inaccessible to good markets as is the case in the west. In fact, there are very few places in the State from which eggs and poultry cannot be gotten to Boston within from two to six hours. It is true, of course, that most of the land here is not comparable with that in the west so far as quality and general fertility are concerned, but it is much better suited to poultry, with the exception that it will not produce as much feed per acre for the hens. Rolling land such as we have enables us to select a suitable sunny location for poultry buildings where they may be protected from winter winds either by a hill or natural forest. Again, our quick soil will grow an excellent windbreak in a very few years. Furthermore, by selecting land for poultry carefully and locating the buildings judiciously an automatic water supply can be obtained for the poultry buildings. This is a labor-saving item that should receive much more consideration than it does in planning poultry projects.

Capital.

One needs very little capital to start in the poultry business as compared with that needed in some other branches of farming. Even a few dollars are sufficient to equip a back-yard poultry plant, and $600 or $1,000 in addition to the land will almost furnish equipment for a one-man poultry project. The great mistake which most people make is in putting too much of their capital in land and equipment and not reserving enough for emergencies. They overestimate their ability and underestimate the amount of knowledge, skill and practical experience required to run a large poultry farm. Were they to invest only a small portion of their funds at the beginning, and be sure their knowledge, skill and experience are keeping pace with the size and development of their plant, much better results would follow and fewer failures would be recorded. Again, many people embark in the poultry business without a well-prepared plan for development. For this reason there is more or less of a waste in capital. If the project were definitely planned at the start and developed step by step, or the additions made year by year, the available capital would be more economically expended. The amateur or inexperienced man should not spend more than $300 or $400 on poultry buildings and equipment the first year, nor should he think of reaching the maximum size of his plant within five years at least.

MARKETS.

There is no State in the Union that presents greater opportunities in poultry culture than Massachusetts. Boston, at one end of the State, and New York City, practically at the other, give access to two of the greatest markets in the United States. The fact, also, that the fancy trade in the former city demands brown-shelled eggs, and that of the latter, white-shelled, gives considerable freedom in the choice of breeds. It is said that Connecticut does not produce enough eggs to supply Hartford, and we are sure that Rhode Island cannot supply Providence nor Massachusetts Boston. This, therefore, makes Boston the greatest egg market in New England, not only because of her great population, but because she is situated farthest from the great egg-producing sections of the country. If reliable statistics could be gathered, we believe they would show that this State consumes as many eggs and poultry, if not more, in proportion to its population than any other section of the country. Furthermore, the quality demanded by the people of New England is far superior, I am sure, to that required elsewhere. On account of the great disparity between production and consumption of poultry and eggs in Massachusetts the producers have practically a retail trade for their products, whereas poultrymen in sections of the country where there is an overproduction are obliged to ship their eggs long distances or seek what might be termed a foreign market. In other words, the poultry producers of this State are nearer the consumer than those of any other section of the United States. I think, also, that we are safe in making the general statement that the middleman's profits on poultry and eggs are much less than those on most farm products. As an illustration of how the market is brought to the poultryman's door, take the summer hotels which are found in all sections of the State, where people from the larger cities spend their vacations. These assure a good price for eggs during the summer months when they are usually cheap in the regular markets. The price of eggs in Massachusetts during the spring and early summer, the period of maximum production, does not reach the low price attained in many parts of the country. This is due to the fact that millions of eggs are incubated at that time, and also because of the very important fact that hundreds of thousands of eggs are shipped to other States. Massachusetts has long been considered the center for hatching eggs and breeding stock of high quality, and this has a double effect in that it not only means high prices for eggs and stock when market prices are lowest, but it lessens the number of marketable eggs at that season, and thereby insures prices of a higher level. In comparing this with a section where practically all eggs produced are placed on the general market, and the hatching eggs imported, so to speak, it is easily seen that the general trend of prices will be much lower in the latter section than in the former.

MARKETING.

A very large proportion of the eggs produced in this State are retailed locally. There are very few towns or villages of any considerable size in which the demand is not greater than the supply. Many of the large producers do not cater to the local retail trade, but prefer to ship their eggs to the large cities where they can secure a special price equal to or even greater than the retail price in their home town.

Parcel Post.

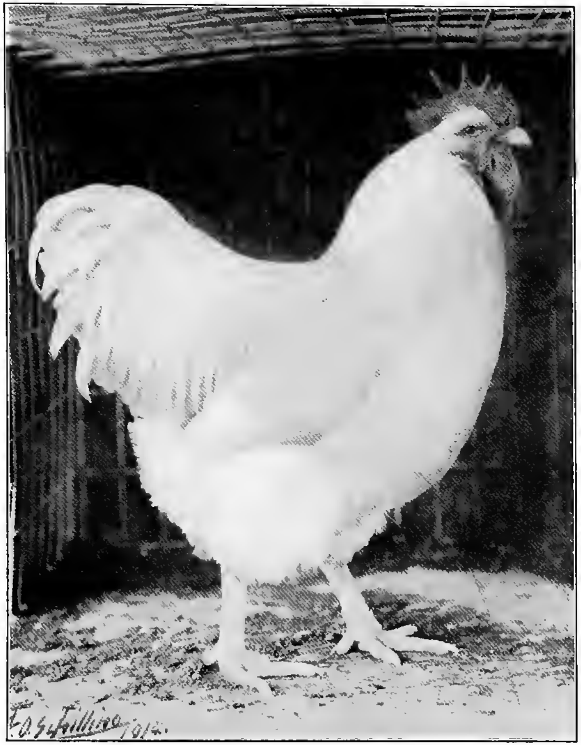
Parcel post is rapidly coming to the aid of many producers in outlying districts. By this means eggs can be sent to the consumer by the producer in 5 to 10 dozen lots, and the container returned at a cost of from 4 to 5 cents per dozen. Many people in the large cities and their suburbs are only too willing to pay a little above the retail price in order to get eggs of first quality. Reports from postmasters in various parts of the State show that large quantities of eggs are already being marketed in this way. Dressed poultry are also finding their way to market by parcel post. In most parts of the State a dressed fowl mailed in the afternoon reaches the consumer in time to be used for dinner the next day. Many producers have marketed their products during the entire summer in this way, with good results. The fact that Massachusetts is a small State, and the rural population small, makes it an ideal State for this method of marketing. Parcel post for handling poultry lends itself best to sections of our country where the intelligence of the farmer is relatively high, in order that the birds may be properly fattened, dressed and packed. We believe Massachusetts excels in this respect.

Express Companies.

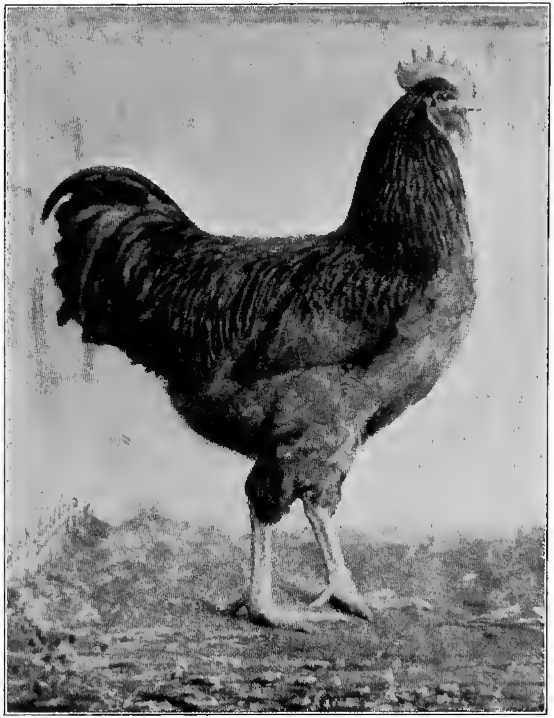
Express companies are only too anxious to assist poultrymen in marketing their products. They are willing at any time to take eggs and poultry, dispose of them through their agency department, and after deducting their commission and express charges, return the balance to the producer. It is easily seen that inasmuch as these companies have a double interest they will seek the highest price possible for their customers. It is not known to what extent the express companies contemplate branching out in the marketing of eggs and poultry, but if it is done to the extent that present indications warrant, it will be a great boon to the outlying districts. One poultryman in a neighboring State told me that the prices express companies can get at times are more than satisfactory.

Marketing Associations.

Up to the present time very little has been done by poultry or egg marketing associations. No doubt this is due to the fact that the local markets are so good in most places. This means of marketing lends itself admirably to sections several miles from markets where the annual production of individuals is not very great. By co-operation there is considerable saving in labor and expense; more frequent shipments can be made and therefore fresher products placed in the hands of the consumer. This method of marketing poultry and eggs is used by hundreds of communities in Canada and the western States, as



White Wyandotte cock, first prize, Chicago Show, 1914. Raised at Vineyard Haven, Massachusetts. (Photograph by permission of "Owen Farms," Vineyard Haven.)



Rhode Island Red cockerel, first prize, Chicago Show, 1914. Raised at Vineyard Haven, Massachusetts. (Photograph by permission of "Owen Farms," Vineyard Haven.)

well as in foreign countries. It is now being considered by a number of communities in this State, and will no doubt be found advantageous by a few at least.

From the above it is evident that the poultry keepers of this State have all the advantages possible in marketing their products. Parcel post, express companies, excellent local markets and co-operative associations will in the future enable them to reach the consumer without leaving very much in the hands of the middleman.

FEEDS.

The fact that all the feed required for poultry cannot be produced in Massachusetts leads many to think that poultry keeping cannot be made very profitable. We believe this should give no cause for alarm, however, for when we compare the prices of grain, poultry and eggs in the great grain-producing sections of the country with those of ours, we find the advantage is still in our favor. In October, 1911, farmers in the middle west were selling live chickens at 7 cents per pound, and at the same time they were bringing from 14 to 18 cents here. In September, 1912, eggs were selling in Massachusetts at 40 cents when farmers in Wisconsin were getting only 22 cents. On November 20, 1913, a farmer in southern Minnesota wrote me that all he could get for eggs was 24 cents, and the retail price here was from 55 to 70 cents per dozen. On the other hand, we find no such variation in the prices of feed.

I spent several years of my life at both Warren, Illinois, and Oshkosh, Wisconsin, and it may be of interest to compare prices in these places with those in Massachusetts. Accordingly, on November 11, 1914, I communicated with a reliable man in each place who buys his feed at retail. The results are given below: —

TABLE 1. — *Comparative Cost of Feed (per 100 Pounds).*

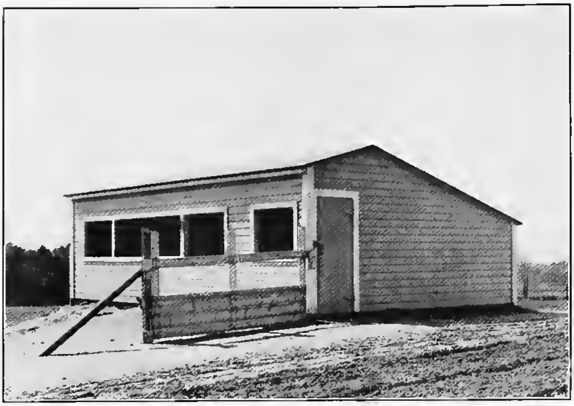
NAME OF FEED.	Amherst.	Oshkosh.	Warren.
Whole corn,	$1 75	$1 60	$1 34
Wheat,	2 20	2 08	2 00
Oats,	1 95	1 65	1 56
Barley,	1 77	1 77	1 56
Cracked corn,	1 75	1 90	1 75
Corn meal,	1 75	1 90	1 75
Ground oats,	1 95	2 00	1 60
Bran,	1 40	1 35	1 30
Flour middlings,	1 75	1 65	1 50
Red Dog Flour,	1 95	1 65	1 60
Gluten feed,	1 70	1 50	1 60
Linseed meal,	1 85	1 90	1 75
Ground alfalfa,	1 55	2 00	1 75
Beef scrap,	2 75	3 50	2 00
	$26 07	$26 45	$23 06

What interested me most was the slight difference in the cost of keeping a hen for a year in those sections and in Massachusetts. Given below is the comparative cost of 100 pounds of mash and 100 pounds of scratch feed in each place. Data from experiment stations and other sources show that a good laying hen eats on an average about 100 pounds of feed, grain and mash annually.

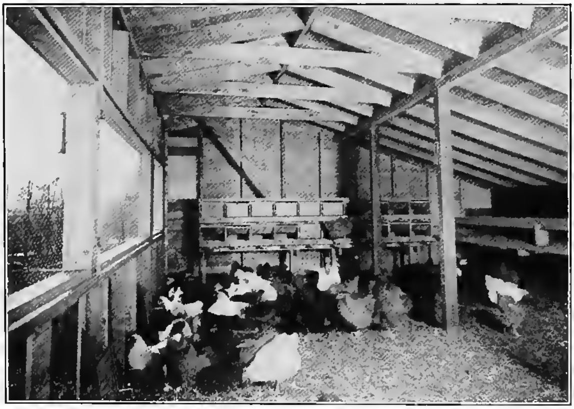
Assuming that she consumes equal quantities by weight of each, the cost of keeping a hen a year in each place is as follows: —

TABLE 2. — *Comparative Cost of Keeping Hen One Year.*

NAME OF FEED.	Amherst.	Oshkosh.	Warren.
Mash (per 100 pounds).			
Corn meal,	$1 75	$1 75	$1 75
Ground oats,	1 95	2 00	1 60
Bran,	1 40	1 35	1 30
Flour middlings,	1 75	1 65	1 50
Gluten feed,	1 70	1 50	1 60
Linseed meal,	1 85	1 90	1 75
Meat scraps,	2 75	3 50	3 00
Cost of 700 pounds,	$13 15	$13 65	$12 50
Cost per 100 pounds,	$1 88	$1 95	$1 79
Grain.			
Corn meal (200 pounds),	$3 50	$3 80	$3 50
Wheat (100 pounds),	2 20	2 08	2 00
Oats (50 pounds),	98	83	78
Cost of 350 pounds,	$6 68	$6 71	$6 28
Cost per 100 pounds,	$1 90	$1 91	$1 80
Grain (50 pounds),	$0 95	$0 95½	$0 90
Mash (50 pounds),	94	97½	89
	$1 89	$1 93	$1 79



Laying house for 100 hens, Massachusetts Agricultural College, Amherst.



Interior of 100-hen laying house, Massachusetts Agricultural College, Amherst.

Incubator cellar.

It is readily seen from these data that the average cost of keeping hens in the middle west and in Massachusetts is practically the same if feed is purchased at retail prices. This, coupled with the fact that on that same date eggs were retailing here at from 50 to 70 cents per dozen, and at 30 cents at both Warren and Oshkosh, gives the Massachusetts producers a great advantage. It must be kept in mind, also, that our milder climate means a much higher egg production at that time of the year. The farmers in the middle west who raise all their grain have the advantage, as they can value it at wholesale instead of retail prices, but even then the difference in cost of feed per hen would not be more than 20 to 25 cents per year, which would be fully counterbalanced by the difference in price of one dozen eggs during the fall or winter season.

Modern Poultry Equipment.

The rapid strides made in poultry keeping during the last two decades have eclipsed that of most other lines of farming, due largely to the efficient apparatus and equipment which necessity has brought into use. When the incubator came out a number of years ago thousands of people held up their hands and said that good, strong, vigorous chicks could not be hatched in a wooden box, believing, many of them, that the hen transmitted to the chick through the shell, not only vitality but certain poultry instincts among which was that of egg production. These notions have not only been proved false, but at the present time the "wooden box" has developed to such an extent that we have incubators varying in egg capacity from 40 or 50 to as high as 20,000 or 25,000, and, as already stated in a preceding paragraph, one hatchery in this State is capable of incubating 1,000,000 eggs annually.

The influence of the incubator is much greater than many of us suppose. It not only enables us to hatch eggs in large numbers if necessary at any season of the year, independently of the hen, at a low cost and with a minimum amount of labor, but one of the far-reaching advantages is the fact that it is enabling us to breed the maternal instincts out of the hen. The advantage of this can readily be understood when we realize that broodiness is one of the great factors in cutting down egg production among our American and English breeds.

Many methods for brooding chicks artificially also have been devised. These cover a great range, with the fireless brooder at one end and the large pipe brooder house at the other. Intermediate between these are innumerable kinds of hovers, brooder stoves, etc. Our modern brooding equipment not only furnishes the means of caring for chicks in larger flocks, but concentrates the work and cuts down the labor to a minimum. This is evident from the fact that the pipe brooder houses are capable of caring for from 1,000 to 3,000 chicks at one time. Brooding equipment has not yet reached as high a point of efficiency as that of the incubator, but we hope in a few years to place the former on just as sound a working basis as the latter.

Modern methods of dry mash feeding, together with the hoppers and other utensils that make up our feeding equipment, enable us to keep a larger number of birds at a much lower cost and with less labor than formerly. Many kinds of automatic hoppers are being tried out, and it is possible that we may be able to so equip our houses that the hens will do their own feeding.

What has been said concerning hoppers can also be applied to drinking fountains, as some of the newer ones on the market are so made that the water is kept warm during the winter season by the use of a small lamp.

The Large Flock House.

The large flock house has come to stay. I do not refer to flocks of several hundred, but to those of 100 to 150. It has been shown conclusively that flocks of this size can be kept profitably, and the egg production will be nearly as high as that of smaller flocks. The great drawback in the past in keeping large numbers in one pen was the inability to devise a house that would comfortably accommodate such a flock. Modern poultry houses will do this.

Shipping Cases for Baby Chicks.

No one can tell of the far-reaching results when suitable shipping cases for baby chicks are invented to keep pace with incubator development. These, together with the incubator, enable thousands of back-yard poultry keepers and others, who are not able to keep breeding flocks, to get baby chicks in good condition at a low cost.

With our present knowledge of the care and management of poultry we are able to do many things that were not thought possible a few years ago. For example, as a boy, I learned that Brahmas were not of any practical or utility value; that they were just a fancier's bird that required a year for development; that they were poor egg producers, poor mothers, but great sitters. They were poor mothers because the immense amount of toe and shank feathering kept them from seeing their chicks, and as a result their babies were trampled to death.

All these notions came about through ignorance of the best methods in the care and management of this variety. To show the falsity of these I have only to cite that there is one man in Massachusetts who does not pose as a fancy breeder at all, but simply as a utility man. He keeps a very large flock of Brahmas, and they have paid for his farm, given him a good bank account, kept his family in good circumstances and educated his children. He considers his Brahma stock even better than bank stock. What is the secret? There is none. This man has learned how to handle Brahmas. He knows when to hatch them and how to care for and manage them throughout the various seasons of the year. "Knowledge is power."

Probably one of the most notable achievements in poultry culture is placing the duck business on just as sound, safe and profitable a basis as any line of manufacturing or practically any business. Some of these duck men through long years of study have at last reached the point of efficiency where they are able to hatch ducklings practically the year round. One of the greatest troubles was to get their breeders to produce eggs during the fall and early winter months. Recently, however, some of them have learned that by hatching ducks at a certain time, with good management they are able to bring them to laying maturity during the late summer or fall, so that the output of the duck plant now practically covers the entire year.

What has been said in regard to the efficiency of the duck business is almost as true of the South Shore soft roaster business. The art of caponizing and the skill in using modern poultry equipment are enabling the people of that section to take advantage of the high prices during the period of scarcity of meat from March to July.

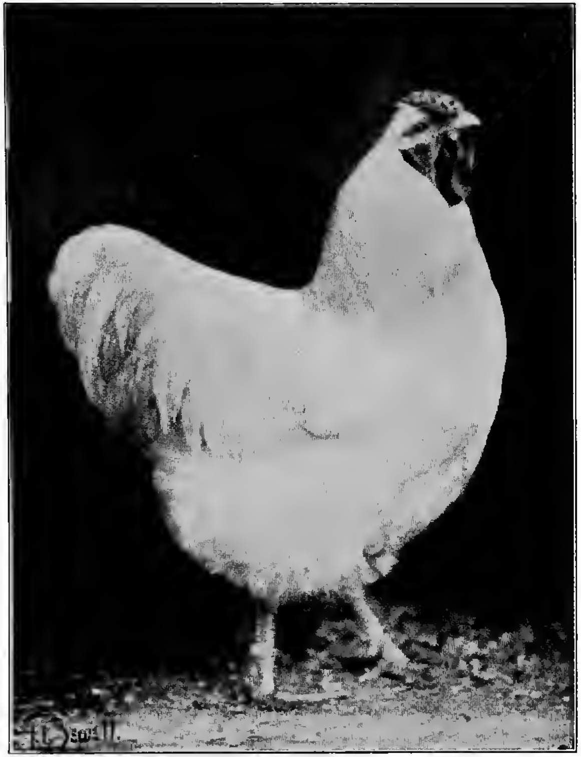
It is easily seen from the above that poultry culture has not only made rapid strides in the last few years, but it is fast being placed upon a sound business basis.

LABOR.

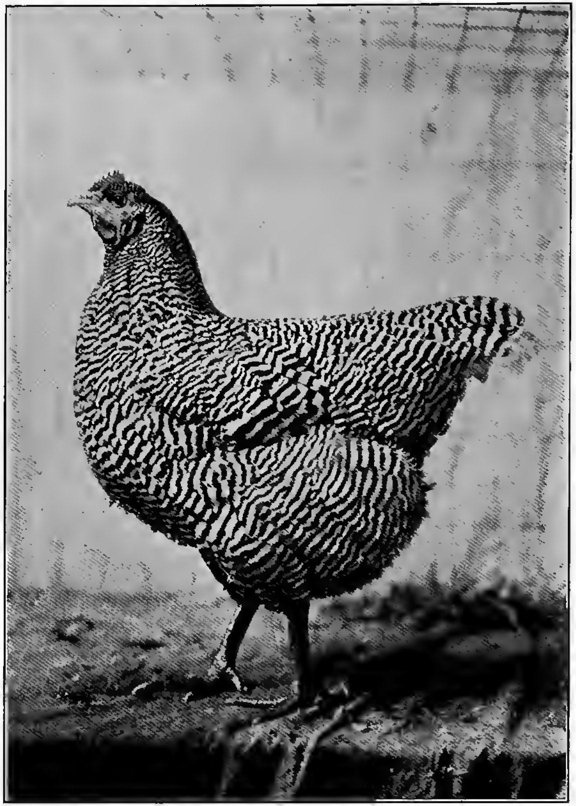
Successful poultry keeping like everything else requires plenty of well-directed labor, but it is not of the heavy, strenuous kind found in many other lines of farming. About the heaviest work connected with it is handling bags of grain, and if one has a well-placed grain room the feedman will do that. Keeping poultry may well be termed busy work, and that is one reason why it appeals to retired or broken-down business men who are not capable of existence unless they are working. Whether the labor is productive or not does not concern some, as long as they find pleasure in the work. Most of the labor on a small poultry farm can be done by women or men not capable of doing heavy work. Another very attractive feature about poultry keeping is that very little night work is required, due to the fact that hens go to their roosts and come down from them with the sun. Of course, during the incubation and brooding seasons, and those periods when the poultryman is selecting his breeders and studying his birds, some late labor will be necessary, but work of that kind is so interesting that it is considered a pleasure rather than a drudgery.

TRANSPORTATION FACILITIES.

No State in the Union is more fortunate than ours in transportation facilities. It is literally covered with a network of railroads, besides being cut up in a similar way by trolley lines. The places, therefore, that are not reached by either one or the



White Orpington cockerel, first prize, New York Show, 1914. Raised at Vineyard Haven, Massachusetts. (Photographed by permission of "Owen Farms," Vineyard Haven.)



Barred Plymouth Rock hen raised at Waltham, Massachusetts (Photograph by permission of American Poultry World.)

other are very few indeed. The fact that trolley lines run express cars means good service in every part of the State. Again, in a section of the country so densely populated as this many railroad trains must be run daily in order to handle the traffic. Quick and efficient service is the result.

One of the greatest assets of the farmer is good roads, and we venture to say that no State has a better system of State roads than Massachusetts. Only those who have been obliged to use poor roads can fully appreciate the value of good ones. It is not overestimating to state that with a system of roads such as we have here fully half the time usually spent in marketing and hauling is saved. With the present-day prices of labor this is an item well worth considering. These exceptional facilities in transportation, therefore, enable the poultrymen of the State to get their products to market quickly, in good condition and at a low cost, to say nothing about the labor and expense saved in obtaining grain and other raw materials.

Construction.

It is true that the cost of lumber and labor are much higher at present than a number of years ago, but our modern methods of construction and management nearly offset the difference. The building of wider houses and keeping hens in flocks of from 100 to 150 has decreased very materially the cost per hen for housing. For instance, a house 8 feet deep and 100 feet long will house about 160 to 175 hens, and one 18 feet deep and 100 feet long will house 400 hens. But the former has 216 running feet of wall and the latter 236. The extra 20 running feet of wall and additional roofing more than doubles the capacity of the house. Again, certain manufactured commercial materials are gradually taking the place of lumber, and sand and gravel can be obtained practically for the handling for concrete construction.

Quick Returns.

There is probably no line of farming that furnishes quicker returns than those obtained from poultry. To those who have but little capital this is an important consideration. If one begins by buying mature pullets or hens the income is immediate, and even if he starts with eggs for hatching, broilers will be ready to market in from ten to twelve weeks, roasters five to seven months, and the pullets will begin to lay when from five to eight months of age. The opportunity to turn one's capital several times during the year is equivalent to having double or triple the amount. This compared with some other lines of farming, where one or more years are required to produce a crop, gives poultry keeping a big lead. Another thing of great importance is the fact that every kind of poultry business is done on a strictly cash basis. This means quick money and no bad bills.

POULTRY AND EGGS AS DELICACIES.

Eggs and poultry have long been considered delicacies for the table. Our greatest of all feasting days, Thanksgiving Day, is not enjoyed to the fullest extent unless the table is decorated with the king of fowls, the New England turkey, and yet on account of the scarcity and high price of these the last few years many of us have been glad even to get a good capon, fowl or chicken. Throughout the entire farming sections of the country the highest honor paid to a guest at the dinner table is to place before him a delicious chicken or fowl cooked by the farmer's wife herself.

Eggs, on account of the ease with which they can be obtained, their palatability, digestibility and the many ways in which they can be prepared, have become one of the principal foods for the sick and convalescent. Their almost absolute freedom from injurious disease germs highly recommends them for this purpose. The size of the egg and condition of the shell make its use not only convenient, but very economical, as it contains all the rich nutriment that a child or invalid should take at one time. The structure and condition of the case with which the hen encloses the egg preserves it for a considerable length of time without deterioration. There is practically no waste, therefore, in the use of eggs, and they are unsurpassed in richness of flavor. Again, the fact that an entire carcass of a fowl is purchased at one time, and that its size can be regulated to meet the convenience of the family, gives it a great advantage over that of other animals on the farm.

It is greatly to be deplored that such good wholesome food as eggs and poultry of all kinds should be so scarce and expensive that they are reserved for the sick, the wealthy and for special occasions only, instead of being within the reach of the poor and those of moderate means.

Scarcity of Meat.

Each year meat of all kinds, except poultry, is becoming scarcer and scarcer, and the price therefore higher and higher. A careful study of the receipts at the Chicago stock yards cannot fail to convince one that beef, pork and mutton will soon be beyond the reach of the family of ordinary means, and the worst feature about it is the fact that no relief is in sight. As far as we are able to learn, no increased production of these meats can be expected within the next few years, and the recent tariff act has had no perceptible effect upon the price, at least, to the consumer. We must, then, look more and more to poultry products to make up this deficit in meat supply. The large roaster plants and duck farms are doing a great deal toward it now, and we hope to see very soon a decided impetus to goose farming and turkey raising.

The Egg-eating Habit.

The extent to which the egg-eating habit has increased during the last few years is very noticeable. A careful canvass will show that many families are now having eggs for their breakfast, who, a few years ago, either did not care for them or felt they were too expensive. Not only has their use increased in the private family, but egg sandwiches and egg drinks are now popular at restaurants and soda fountains. A man remarked in my hearing not long ago that there is not a drug store in the country, of any consequence, but what keeps a large dish of fine fresh eggs on the counter. This was not the case a few years ago. No doubt the high price of meat and our habits of living in recent years have done much to bring this about. The people of New England were the first to learn the true value of eggs as a food, and many of them have commented, in talking with me, on the fact that some people will quite willingly pay

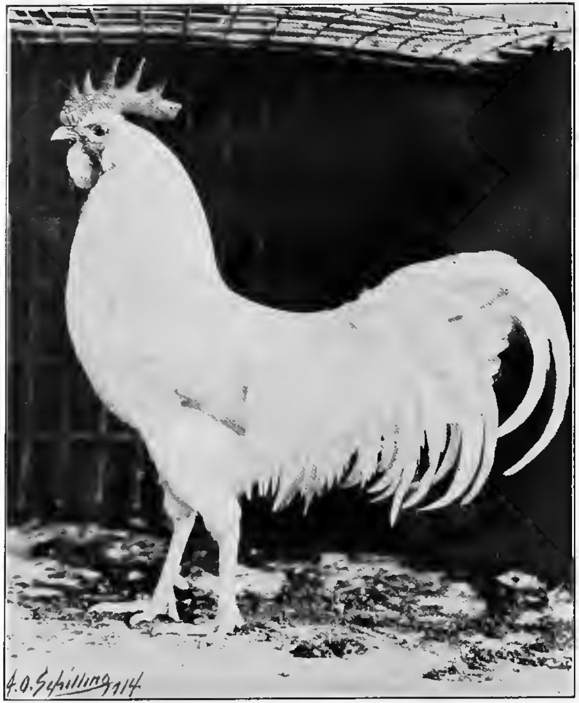
5 cents apiece for oranges and apples, or buy plums at the rate of 2 or 3 for a nickel, and at the same time make a tremendous kick and talk about combines or trusts when good wholesome eggs sell at 4 or 5 cents each. This same egg-eating habit has taken possession of Europeans also. About four years ago a commission was appointed in England to investigate the high price of eggs. In their report it was stated that one of the most important causes for their scarcity and high price was the development of the egg-eating habit among the peasants of western Europe, in southern Russia and certain parts of Germany and Austria. All these facts are evidence of the increasing demand for poultry and eggs, and the opportunities in poultry culture in Massachusetts will not be confined to the next few years, but will continue for many years to come.

Poultry Instructors.

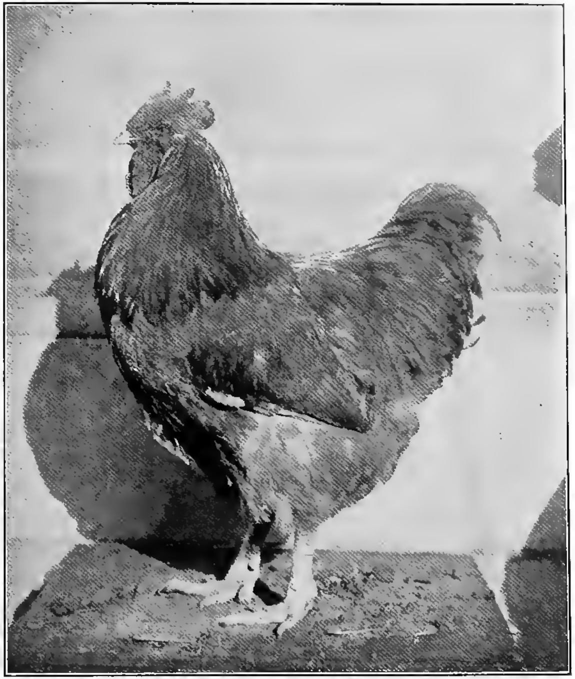
There never has been a time in the history of education when there was such a demand for a particular class of people, and at the same time so few qualified to meet this demand, as we have in our instructional work in poultry culture at the present time.

During the last twelve or fifteen years poultry departments have been established in nearly all of our agricultural colleges. A large number of county agricultural schools have been organized in various parts of the United States, and agricultural departments have been established in high schools. Furthermore, there have been instituted in the country quite a number of what are termed agricultural high schools. In nearly all of these institutions poultry instruction has been demanded, and to meet this demand a great many people have taken these positions who have not been trained professionally for that kind of work. Such positions require men with, as one can readily see, a particular kind of training, one covering all three phases of the work, — scientific, practical and professional or pedagogical.

I believe there are no greater teaching opportunities in the country to-day than those offered to young men who will fit themselves for teaching poultry culture in these various schools. In addition to teaching there has come a great demand from our agricultural experiment stations within the last five years for trained men to carry on experimental work in poultry



White Leghorn cock, first prize, New York Show, 1914. Raised at Vineyard Haven, Massachusetts. (Photographed by permission of "Owen Farms," Vineyard Haven.)



Buff Orpington cock, first prize winner at Holyoke Show, 1913. Raised at Agawam, Massachusetts. (Photographed by permission of W. E. Blodgett, Agawam.)

keeping. This offers a still greater field at the present time so far as salaries and opportunity for original investigations are concerned.

POULTRY JOURNALISTS.

Poultry journalism is gradually being raised to a higher plane, and there are great opportunities in this line for young men and women. At present our remuneration for such work is not what it should be, but this is due to the fact that many people are only too glad to contribute articles free of charge for the advertising they get. As can readily be seen, this has a tendency to place poultry journalism on a much lower plane than would otherwise be the case. There are splendid opportunities in poultry journalism for young men with careful scientific training, together with broad practical experience.

MANAGERS OF POULTRY FARMS.

The demand for men to take charge of poultry farms is several times greater than the supply. We have reference to men well qualified for the work, and not those who are simply looking for such positions. One man told me he would pay $2,500 for a manager of his poultry plant, but he wanted one who was worth it. People who are investing their money in farms and poultry equipment are looking for men who have both scientific and practical training, some experience and considerable business ability. Opportunities for such men are unlimited.

Poultry keeping is no longer confined to one particular line of work. It has become a thoroughly specialized line of agriculture, and there are opportunities in any one or more of these lines. The most important phases of the work are the following: —

MEAT PRODUCTION.

Roasters.

The marketing of fowls and cockerels in the fall is an important part of the poultry work on every general farm in the United States. But there are a number of poultry farms in this State that have made the production of roasters a specialized line of agriculture. Most of them are in the South Shore District mentioned above. This district includes the towns of Hanson, Rockland, Hanover, Pembroke, Marshfield, Duxbury and Abington in Plymouth County. The systems or methods of carrying on the work vary to the same extent as those found among the market-egg producers. On some of these farms no breeders or layers are kept except for family use. Eggs for hatching are bought and incubated from July to November, the chicks brooded in long pipe brooder houses, grown to maturity in colony houses, and placed on the market from March to July. The killing and picking are done principally by one man who runs a commercial establishment of that kind. There is no expense to the producer in advertising and selling, as the buyer comes to the farm every week and takes those that are ripe (in good condition) till they are all gone. No doubt more poultry history has been made in this section of the State than in any other part of the country, at least so far as utility poultry farming is concerned. It is here that caponizing was put to practical use on a large scale, and the large pipe brooder house reached its maximum use.

Broilers.

The production of broilers as a specialized line of agriculture has never met with any great success. This is due to a number of causes, the first of which is the lack of knowledge in systematizing and conducting such an enterprise; second, the methods used were too intensive; and third, the cold-storage plants brought down the price at a time of the year when the business should yield its greatest profit. When these broiler plants began to operate they found there was an over-production from June till October, during which time the cold-storage plants filled up, and kept the price down until the following spring. One of the great difficulties encountered was the inability to obtain good, fertile eggs every day in the year. In order for a large, expensive plant to be successful, several hundred eggs must be set daily, and the period when they are needed most is that in which eggs are very scarce and hatch poorly. For example, to pay a high price for eggs during the months of November, December and January, hatch not more than 30 to 40 per cent of them, brood and grow the chicks with artificial heat with the usual accompanying losses, means high-priced meat. The man who undertakes this work should be well equipped in every sense of the word. Poultrymen who have a special trade for broilers and can secure hatchable eggs the entire year may do well if they understand the business.

MARKET EGG FARMING.

Eggs, Fruit and Hay.

There are very few poultry keepers in the State who do not at some time during the year produce marketable eggs, but under this heading we have reference to that class of poultrymen who make a specialty of this line. These could be divided and subdivided into a large number of classes on account of the great variations and combinations under which their work is carried on. Only a few, however, will be mentioned. There are many who run what might be termed an egg factory. They buy pullets in the fall, keep them until the following summer and dispose of them for meat, clean and disinfect their houses and begin again with new stock; no breeders are kept or stock raised. On farms of this kind some other line of agricultural work is usually combined with that of poultry. Poultry and hay, or poultry and fruit, make a good combination. One man with the former combination who keeps about 1,000 hens states that with very little additional fertilizer he is able to sell about $1,000 worth of hay annually, and one with the latter combination markets about $4,000 worth of poultry and eggs. Most of the people, however, have more complete poultry equipment. Some buy baby chicks, brood and grow them to maturity, while others who feel they can profitably do so buy eggs, do their own hatching as well as rearing, and still others keep their own breeding stock. The last system is much more complicated, as the production of good, hatchable eggs year after year requires considerable skill. The production of market eggs is the major line in poultry farming. The plan or system that one adopts should depend first upon *himself,* second upon his knowledge, skill and experience, and third, his facilities.

HATCHERIES.

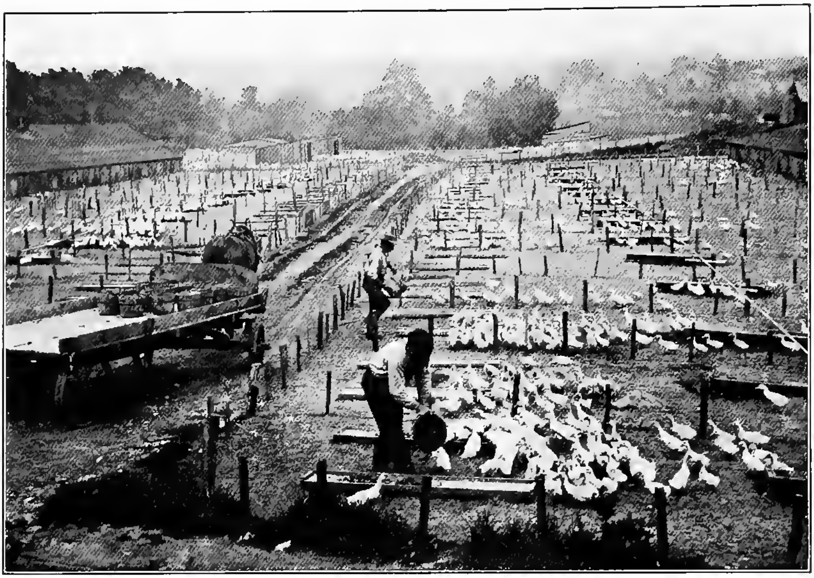
The Mammoth incubator has come to supply the demand for baby chicks. There are thousands of people who are not equipped to incubate their eggs, either by natural methods or artificially, so the hatchery is supplying a long-felt want. A large number of these are scattered throughout the State. Here eggs can be sent for hatching and baby chicks returned by express. Some of these hatcheries are run by men who make a regular business of hatching for other people, while others have their own breeding flocks for supplying eggs. At this writing the largest hatchery in the United States is being built at Holliston, Massachusetts. Its capacity is 166,000 eggs at one sitting or about 1,000,000 eggs annually.

THE BABY CHICK BUSINESS.

There are a number of poultrymen who make a business of selling baby chicks. Some of them find a market for these throughout the entire year, while others supply them only during the main breeding season. This business has developed to such an extent that some of the poultry supply houses in Boston deal in baby chicks just as in grain and other supplies, and many thousands pass through their hands annually. These houses are a source of supply for a large number of back-yard poultry-keepers.

POULTRY BREEDING.

This line of specialized poultry keeping requires the greatest amount of knowledge and skill, and yet it is generally the first to be taken up by amateurs. We have now two classes of breeders, the exhibition and what I like to term the "standard utility" breeders. The former breed exhibition stock almost exclusively, and furnish breeders and eggs to others in their class, and also the foundation stock for most of the utility men. Many of these do well, as they usually begin in a small way and learn the business by hard knocks. It is a side line with them for a number of years at least, and as soon as they find they can succeed with poultry, they drop their other employment.



A large Massachusetts duck farm.

A prize tom, Concord, Massachusetts.

The standard utility breeder is of more recent origin. He is a result of the great demand for lower-priced hatching eggs and stock. There are some of these who contract practically all their eggs the year round to the meat producers in the South Shore District. Some have incubators of their own, and when there is a lull in the egg trade they hatch their surplus eggs and sell the baby chicks or keep them for their own use. It seems to me that this field of poultry work has the prospects for a great future. There is a tremendous demand for eggs for hatching from good, strong, vigorous utility stock. I attempted to place an order with one of these utility breeders about the middle of December 1914, and was informed that there were orders ahead of mine aggregating 20,000 eggs. This man keeps 350 females, and as can be seen is unable to meet the demand for hatching eggs. Many of the exhibition breeders are assisting in supplying this demand by keeping what they term utility pens, or matings.

The Duck Business.

This is the one line of poultry farming that has been reduced to a system. The soft roaster business is fairly well systematized, but not nearly to such an extent as that of the duck business. Duck eggs hatch well and the ducklings mature early, usually at from ten to twelve weeks of age. Very few diseases affect them, and they find a ready market the entire year. The fact that they can be grown on the same ground for a number of years without any trouble makes them a surer crop than chickens. There are a number of men in New England who market annually from 20,000 to 50,000 green ducks besides selling many for breeders. A man with a good duck plant is practically independent; that is, if he understands the business. Climatic conditions are such in this State that duck raisers are usually able to obtain green rye during the entire winter season. This is an item of considerable importance, inasmuch as a large portion of the ration of both ducks and ducklings consists of green stuff.

At Wrentham, Massachusetts, almost within hailing distance of each other, are three large duck growers whose annual output is not far from 100,000 green ducks, and two of them are now enlarging their plants with a view of increasing the output about 50 per cent. These duck farms are all examples of beginning small and growing large on the profits.

Certain varieties or families of ducks have been selected and bred for the production of white eggs, and the producers are able to get 5 to 8 cents per dozen more than for hens' eggs. The 200-egg duck has become an actuality. The following record sent me by a man living on the border between Massachusetts and Rhode Island is proof of this: —

TABLE 3. — *Estimated Value of Eggs received from 15 Ducks beginning November 1, 1913, and ending October 31, 1914.*

MONTH.	Number of Eggs.	Price per Dozen (Cents).	Amount.
November,	58	50	$2 42
December,	117	60	5 85
January,	136	48	5 44
February,	66	40	2 20
March,	256	35	7 46
April,	435	30	10 87
May,	413	28	9 63
June,	382	28	8 91
July,	422	30	10 55
August,	368	35	10 75
September,	253	42	8 85
October,	194	50	8 08
Total,	3,100	-	$90 99

The average number of eggs per duck was $206\frac{10}{15}$.
Average value of eggs per duck, $6.06.

Ducks are hardy rapid growers, and about the right size for family use. A few raised on every farm help greatly to keep down the meat bills.

TURKEYS.

At one time New England was the great turkey-producing section of the country, but the disease known as blackhead practically wiped out the business. The general opinion prevails that when once this disease gets a foothold on a farm very little can be done with turkeys. The germs that cause blackhead are quite widely distributed. They are found to infest

Driving the geese to market, Bristol County, Massachusetts.

A Middlesex County turkey farmer.

A prize-winning flock.

the digestive tract of fowls and chickens, but are not extremely harmful or deadly unless found in great numbers. It is almost impossible to keep a place free from them, as they are carried from farm to farm by sparrows, pigeons and possibly other birds. Notwithstanding this, we have seen several flocks during the last few years, and *one* in particular was raised under the most unnatural conditions; that is, it was kept in the same yard (a small pasture) with hens, ducks and geese, contrary to the modern methods of growing good turkeys, and in spite of germ theories a large flock of healthy turkeys was raised. Success in this case was due almost wholly to the fact that the owner was very sympathetic in nature, a good nurse and an interested worker. We may find that extreme care, sanitation, better methods of feeding and some nursing will again enable us to carry on this line of poultry farming successfully. If good results can be obtained under the conditions mentioned above, think what we should be able to do with our flocks spread out over fields and wooded districts, instead of being confined to already infested yards. Massachusetts is not lacking in land for this purpose, as there are thousands of acres of woodland, dry and rolling, ideal for turkey runs.

Production of Squabs.

A number of people in the State have specialized in squab raising with good results. This is a line of poultry work that can be conducted on the intensive plan. It is well adapted to back-yard conditions, and the nature of the work is such that it can be carried on by boys, women or invalids. Furthermore, the equipment for this work need not be expensive.

Goose Farming.

On account of the high price of meat, ideal climate and the large area of suitable land, goose raising is bound to come to the front in this State. Geese, like ducks, are very quick growers, and are ready for market in from ten to fourteen weeks. Being vegetarians, they are great foragers, and very little grain is needed except for the fattening period. A piece of swamp land containing some running water with a portion of the land high and dry for a roosting place is almost ideal for geese, and any amount of such land can be found in this State. Another great advantage lies in the fact that very little outlay is necessary in the way of houses or shelter, as any kind of a shed will do for adult geese even in the coldest weather, and after the goslings are a few weeks old the only shelter needed for them is shade. As the price of feathers is gradually increasing, their value is an item well worth considering. With our cheap land and the high price of meats, this line of poultry farming will receive more consideration in the near future.

Pullet Growing.

This is a line of poultry culture not yet developed, because it is difficult for many to produce good, vigorous stock. Usually poultry raisers do not grow more than they need themselves because of overcrowding, but there is good money in raising pullets for sale, as thousands were sold last season for $1.50 to $2 each. There are hundreds of people who would not try to raise chicks under adverse conditions if they could buy pullets. It would surprise many to know of the thousands that were handled by the commercial firms in Boston last fall, and their sales aggregated only a small per cent of the number that change hands.

Fattening and Killing.

This is a line of poultry work that has not been specialized to any great extent in this State. Many of the large packing houses in the west have fattening stations in connection with their meat-packing establishments, where thousands of chickens are fattened annually.

A great many chickens are marketed during September and October, not because they are in market condition, but because of congested quarters or the fear of losing money by keeping them. Good money can be made by buying, fattening and putting these on the market in first-class condition. I know of two high school boys who are doing this in a small way. As their time is limited they fatten only enough to supply regular customers at retail prices, and their profits are good.

KEEPING SUMMER LAYERS.

There are men who keep poultry only a part of the year and find them very profitable. They live near summer resorts and buy hens in June that have been shipped from the west. On arrival, they are usually quite thin and are purchased by the pound. They take on flesh rapidly, lay well during the summer months, and are sold early in the fall for roasters. Being fed on hotel waste mostly, the cost of feed is small, and, as the eggs are sold to resorts at from 40 to 50 cents a dozen, the profits are good. More might find this line of poultry culture profitable.

The foregoing, with the exception of the last four, are all specialized lines of poultry culture in this State. They have been treated to some extent separately, not only to show the opportunities in the various branches, but to show the advancement made in this particular line of agriculture during the last few years.

There are two other lines of poultry keeping, not of a specialized nature, that should not be overlooked because the opportuntities in them are usually much greater than in the more specialized lines, especially in proportion to the size of the project. I have reference to the farm and back-yard flocks.

THE FARM FLOCK.

Statistics show that notwithstanding the fact that there are hundreds of large egg farms in the eastern part of the United States, about 90 per cent of all the eggs produced in the country come from general farms where poultry is kept as a side line. To my notion the farm furnishes more nearly the ideal conditions for poultry, and it is astonishing and also to be regretted that better and larger flocks of poultry are not found on all of the farms in this State. So much range can be given the birds that the feed bill is cut down very considerably. The farm buildings, such as barns, sheds and tool houses, as well as orchards, furnish excellent protection from cold winds, so the hens can range quite freely during the winter and early spring. There is nothing we can do that will increase the strength of the germ and therefore insure better hatches than treatment of this kind. Again, chicks grown under farm conditions are apt to be more vigorous than those grown in a more intensive way. Instead of farmers buying breeding males year after year, they should be selling large, strong, vigorous birds to those who are obliged to grow stock under less favorable conditions. The natural food obtained by poultry on free range and the manner of getting it are important factors in raising good stock. Nothing would increase the size and vigor of the stock throughout the country any more than a larger output of farm-raised breeding stock. Many advertisers are now using the statement that "all our poultry are farm raised." Of course it goes without saying that most farmers would have to select their breeding stock more carefully than at present.

The following data were sent me by a farmer's wife in this State, with the statement that a portion of the corn and wheat fed was produced on the farm: —

TABLE 4. — *Four Years' Record from Farm Flock.*

YEAR.	Number of Females.	Number of Eggs laid.	Number of Eggs set.	Chickens hatched.	SALES.			
					Eggs.	Poultry.	Expenses.	Profit.
1911,	203	28,045	775	642	$645 16	$309 56	$436 13	$518 58
1912,	220	28,833	904	631	802 19	361 45	412 04	751 50
1913,	225	33,896	872	668	868 86	356 42	509 28	716 00
1914,	279	39,907	899	658	1,122 02	303 73	640 01	785 74

BACK-YARD POULTRY KEEPING.

I believe back-yard poultrymen make a greater profit for the amount of money expended than any other class of poultry keepers. They have an advantage in having a portion of the feed for their poultry furnished in the form of table scraps, either from their own table or from that of their neighbors, and they usually sell their products at a special retail price. In addition to these, the amount of time spent in caring for their poultry is not valuable, as this work is considered a side line with them, and the cost of their equipment usually does not exceed a few dollars. Again, a small flock in the back yard makes a very good training school for larger future operations.

This work, together with a correspondence course, or a systematic reading course, and a few live poultry journals, does much to fit one for independent poultry farming. The immensity of back-yard poultry farming in Massachusetts can readily be realized from the fact that 5,000 people within the city of Boston applied for a license this winter to keep poultry. If these applicants keep, on an average, 20 hens each it means that there are 100,000 hens in the city of Boston alone. If 100,000 hens are kept within this congested area imagine what the total must be for all the cities, towns and villages of the State. The profits made from these flocks are often astonishing, as the following data from three poultry raisers will show.

Not long ago I was introduced to a boy twelve years of age who had the reputation of being a good poultryman. He told me of his wonderful success, and I asked him to send me complete data on his poultry work. As he complied with my request I have all the principal facts at hand. He bought 9 pullets and 1 male June 13, 1913, and sold out January 29, 1914, seven and a half months later. During that time he made a net profit of $55.17, not counting labor. He should have given each hen credit for 18 cents' worth of poultry manure. The profits were made by selling eggs for table use and hatching purposes, baby chicks and half-grown stock.

TABLE 5. — *Data on Back-yard Flock for Three Years.*

YEAR.	Number of Females.	Eggs.	Eggs per Hen.	Value of Eggs and Poultry sold.	Expense.	Profit.	Profit per Hen.
1912, ...	25	4,303	172	$234 25	$115 72	$118 53	$4 03
1913, ...	23	3,996	173½	194 36	87 00	107 36	4 29
1914, ...	20	4,169	208	165 27	85 07	80 20	4 01

Data on 16 Pullets for One Year.

Income: —		
Eggs (3,259), ...	$130 17	
Hens, ...	16 00	
Droppings, ...	5 60	
Gross income, ...		$151 77

Expenses: —		
Feed,	$34 28	
Pullets,	20 00	
Total expenses,		$54 28
Net profit or labor income,		$97 49
Net profit per hen,		$6 09
Average number of eggs per hen,		203$\frac{11}{16}$

Failures.

The moment one begins to talk or write about opportunities in poultry culture he is sure to be asked the following question: "Why are there so many failures in the poultry business?" In the first place, I doubt somewhat as to whether there are any more failures in poultry keeping than in other lines of work. Some one, somewhere, at one time compiled statistics showing that only from 3 to 5 men out of 100 are what might be called business successes. If this is true, I think poultry keeping as a business measures up very well with the others.

Those who are best posted in poultry keeping do not wonder at the failures there have been nor will they be surprised to see many more. Just so long as people will outline projects for and undertake to conduct a business of whose underlying principles they are wholly ignorant, just so long there will be failures in that particular business. Most of the failures in poultry keeping have been due to one or more of the following causes: —

1. Ignorance in regard to the amount of labor connected with the business. People get an idea in some way that poultry keeping requires but very little work; that all they need is a house, corn and birds and the hens will do the rest. They soon realize that it is like any other line of work, care and attention to details being necessary to success.

2. Distorted notions as to profits. Occasionally a man who has made an exceptional profit on his hens lets it be known, and at once there are hundreds who are tired of their jobs and begin to annex ciphers to the results, and in a very few moments find themselves almost millionaires.

3. Lack of capital at the crucial moment. Many of the

would-be poultrymen who know nothing about poultry embark in the business, and soon find that experience is sometimes expensive. After a few years they gain considerable knowledge and skill, but by this time their finances are in such a deplorable condition that they are unable to continue.

4. Ignorance of the business principles and methods underlying a large poultry project. I know nothing about the manufacturing of shoes, where to get the leather, the machinery, amount of capital necessary, the profits, etc., and I have often wondered what people would think of me if I were to buy a lot, build a factory and advertise for a manager. I am sure they would think I was crazy, yet scores of people engage in the poultry business under just such conditions and hope to succeed. We find plungers in every line of human activity, and poultry keeping is no exception to the rule, but in the past has furnished a fertile field for them. It is gradually coming to light that these are not the money makers in poultry keeping, and they are becoming fewer each year. Most of these who stay in the business are enabled to do so either by writing a book, establishing a commercial business of poultry equipment or supplies, and using the farm as an advertising agency. On the other hand, the successful poultry raisers are the farmers and poultrymen who begin in a small way and increase the magnitude of their operations as they grow in knowledge, skill and experience. Their success demonstrates that it is not necessary to keep thousands of hens and raise thousands of chicks to make a living, but that better results are obtained by most people from a few hundred hens well kept.

STATE ASSISTANCE.

Opportunities for Preparation and Guidance.

The combined efforts of a number of agencies in the State are doing much to foster the poultry industry and assist poultry raisers to put their business on a good sound basis, and the work is so distributed that it reaches every nook and corner of the State and gives assistance to all classes.

State Board of Agriculture.

This organization has always considered poultry keeping one of the leading agricultural industries of the State, and has done everything possible not only to improve the quality of the stock, but to spread broadcast in various ways much valuable information. To encourage the production of better poultry, a large number of institutes are held each year under the auspices of the State Board of Agriculture in different parts of the State by agricultural societies and poultry associations. Thousands of dollars are distributed in the form of premiums at the different agricultural fairs and local poultry associations. This not only encourages the raising of standard stock, but creates a general interest in poultry associations. Pamphlets and circulars on opportunities, methods, management, etc., are issued from time to time and distributed free of charge.

The Massachusetts Agricultural College.

This institution is doing all it can with its present force, equipment and funds to meet the needs of the poultry men and women of the State. The breadth and scope of its work are shown by the following outline: —

Courses of Instruction.

A regular college course in poultry husbandry.
Summer and winter short courses and an annual convention.
A correspondence course.

Other Means.

Conferring with poultrymen either at the college or their farms on all subjects relating to poultry.
Conducting experiments and publishing results from time to time.
Publishing and distributing circulars and bulletins from time to time on all subjects relating to poultry.
Sending helpful and suggestive exhibits to fairs and shows.

Journals and Organizations.

There are two poultry journals, one a semi-monthly and the other a monthly, published in the State, besides two State-wide poultry organizations and a large number of local poultry associations that are doing a great deal to encourage and standardize the poultry business. From the above it is evident that the would-be poultry keeper in Massachusetts does not lack opportunity for preparation, guidance or encouragement.

PROFITS.

We are asked innumerable questions regarding profits in poultry culture. Does poultry pay? Can a man make a living from poultry? With an investment of $6,000 in a farm, equipment and stock, what profits should a man realize annually?

As man is the controlling factor in poultry keeping, no definite answer can be given to these questions. There are a great many men in this State who are making more than a living from poultry; there are many more who are making a good living from the business; and there are thousands who keep poultry as a side line, either in the back-yard or on the farm, and find it very profitable indeed. But just what a particular man or woman can do who has had very little or no experience is a question no one can answer, as the success of any project depends largely upon the human element involved. The profits per hen should range from $1 to $4 or $5, depending upon the use to which the eggs are put and the method of calculation. Many poultrymen add to the value of eggs produced the value of chicks raised, giving the hen credit for both. By this method of calculation the profits per hen appear large.

From the foregoing it is evident that Massachusetts possesses many advantages as a poultry State, and that poultry culture has developed in recent years into one of our most important lines of specialized agriculture. There are opportunities in the various branches of poultry keeping not offered elsewhere in this country. In taking up poultry culture for a livelihood or as a life work we believe one should prepare for it the same as for any other business or profession. As with any other branch of industry knowledge is power, and experience and skill are necessary to success.

BREEDS FOR THE FARM AND FARMERS AS POULTRY BREEDERS.

JOHN H. ROBINSON.

When progressive farmers generally began to take an interest in improved breeds of fowls, about three-quarters of a century ago, two radically different types claimed their attention. From western Europe came a number of different breeds, mostly small, active and good layers, but often rather delicate, or having some characteristic that is a disadvantage to fowls kept under ordinary farm conditions. From eastern Asia came a big, rugged type of fowl, heavily feathered, docile, inclined to be sluggish if well fed, good for egg production if cared for judiciously, but tending to become too fat for profitable egg production if overfed, and not as well adapted to forage for a living when on short rations as the small, active breeds.

So it happened that from the very beginning of their interest in the improvement of fowls farmers in America began to cross the imported breeds, with the idea of getting an intermediate type of fowl better suited to their needs. With most of those who did this the idea was not to make a new breed or variety. They considered only immediate results. Having crossed two unlike breeds one season and secured fowls of some intermediate type, their practice usually was to mate the crossbred pullets the next year to males of a breed different from either of those first used. The next year they would probably repeat with males of another different breed, and continue thus as long as the results seemed satisfactory.

In most cases results after the first cross became very much mixed. Then the poultry keeper would begin crossing again, sometimes with the same breeds as before, and trying something else for subsequent matings, sometimes taking a different combination to begin with. Occasionally some one secured, either in a first cross or in some later combination with the results from it, males and females which when bred together reproduced their principal characters with considerable fidelity. In this way a good many varieties of fowls were made which attained local popularity, or perhaps attracted wide notice for a short time and then disappeared. A few breeds developed in this way survived. Some of them remain to this time, having all along been bred by a few people who liked them but could never succeed in efforts to make them popular. The Jersey Blue and the Bucks County fowl are examples of this kind.

The Rhode Island Red is probably the oldest of the American breeds now widely popular, although it was the last to be taken up by fanciers and advertised, as a breed, however meritorious, must be before the general public interested in poultry pays much attention to it. According to quite trustworthy accounts the Rhode Island Red was crudely developed on farms in Rhode Island and southeastern Massachusetts twenty years or more before the modern Plymouth Rock appeared, yet outside of the district where it originated the Rhode Island Red was almost unknown until about 1900.

The modern Plymouth Rock was the first breed of the type so many tried to make by crossing to gain wide and permanent popularity. It is known generally as simply the Plymouth Rock, but the term *modern* is often applied when discussing it historically, to distinguish it from one of the earlier breeds of the same general type for which it was named. The older Plymouth Rock was introduced by a Dr. Bennett of Plymouth, Massachusetts, a prominent fancier in the days of the "hen fever," who claimed to have originated it and to have given it the name Plymouth Rock as being appropriate for a breed originating in that locality. There is some reason to suppose that Dr. Bennett, who appears to have been somewhat of a quack, did not make the breed at all, but that it was a local race known as the Plymouth fowl, or, sometimes, the old Plymouth breed, and that while of much the same type as that which was being obtained by crosses of the recently introduced breeds from Europe and Asia, it was of old English stock brought over by early settlers of Plymouth. This early Plymouth Rock for a few years seemed likely to become quite popular, but soon dropped out of sight and was generally forgotten until the man who introduced the modern Plymouth Rock told many years later that the name Plymouth Rock was not originated by him, but that he named his new breed for an old American breed which had once attracted a great deal of attention.

The original stock of the modern Plymouth Rock was produced in Connecticut from a cross of the old native hawk-colored or Dominique stock on Black Cochins. After the Plymouth Rocks were shown, at Worcester, Massachusetts, in 1869, the breed being in great demand and the supply of the original stock much too small to supply this demand, similar fowls were produced by a number of different combinations. The various stocks were soon so blended that it would be hard to tell just what is the actual blood composition of the Barred Rock. The best of the early exhibition strains was developed in Essex County, Massachusetts, and was known as the Essex Strain. There were also some early strains developed for utility without particular attention to exhibition qualities. The most celebrated of these was the Orocco Strain, which was bred for about twenty-five years by a dairy and poultry farmer in Middlesex County, Massachusetts. The Barred Plymouth Rock for many years after its introduction was considered pre-eminently the best fowl for the farm and for general purposes.

The Silver Wyandotte, now called Silver Laced Wyandotte to distinguish it from the more recently developed Silver Penciled Wyandotte, came before the public shortly after the Barred Plymouth Rock. We do not know just where it came from or who originated it. It was brought to public notice by some breeders who admitted that they did not know the origin of the stock that came into their possession, and by some who claimed to know all about it. The claims of the latter, however, are not credited by many careful investigators. The early Silver Wyandotte was not much like the exhibition Silver Laced Wyandotte of the present day in color, but the general appearance was of a very much darker bird. This was because the greater part of each of the laced feathers was black, and the white centers were quite small; whereas now the surface of the feather is white with a narrow black edge or lacing. They were usually a little smaller than the Plymouth Rocks, with shorter, more compact bodies. This variety was quite popular as a farm fowl in its early days, but after the White Wyandotte appeared interest in it waned.

It is not possible in a short article like this to go into the details of the history and description of the numerous varieties of the general-purpose type that have appeared. The facts as to the origin of the first variety in each of the three American breeds of this type have been given to show that the type was made by farmers for the farm. The finished developments of superficial points for exhibition have been the work of fanciers, and the differences in form of body which fanciers regard as constituting breed distinctions are carefully preserved in breeding only by those fanciers who are most particular about breed type. Many fanciers and most practical poultrymen are quite indifferent about maintaining what is regarded as correct shape for each breed.

The Orpingtons, which were quite extensively boomed in this country by fanciers a few years ago, and have been taken up by many farmers in the vicinity of fanciers much interested in them, are of the same general type as the Plymouth Rock, Wyandotte and Rhode Island Reds, and should be considered a modern English pattern of this type. They are a little larger and heavier than most poultry keepers here want fowls of this class. They have white skin and the flesh-colored beak and legs which in England are preferred in table poultry. While different varieties of the Orpington were made in different ways, and probably some stocks of the same variety are of somewhat different composition, the foundation of the Buff Orpington, which is the most popular, was an old English local breed known as the Lincolnshire Buff. The Sussex fowls, which are now being bred by a number of breeders in this country, are more of the type of our American general-purpose fowls, but have the white skin and flesh-colored legs common in England. These Sussex fowls are of a very old race, having been bred for centuries without established color varieties in a district supplying the London market with poultry.

As far as practical values go the breeds of this type are so nearly equal that it makes little difference which is used. The different varieties of the breeds are supposed to be identical except in the superficial points of color and comb, which determine variety and sub-variety character. The differences between different stocks or strains of these breeds which may be observed in comparing particular stocks are not due to breed or variety differences but rather to the quality of the stock as determined by the way it has been bred and grown. Indeed, as far as practical poultry culture is concerned these breeds are, as some fanciers think that they should be, in the Standard classification, — one breed with many varieties and sub-varieties. And although many fanciers try to maintain as sharp distinctions between them as possible, some of the most successful exhibitors, while extremely careful to follow Standard requirements in most particulars, systematically breed for a shape that is not the generally preferred type of their breed, but more nearly approaches that of some other breed of the same class. They can do this because the verbal descriptions of shape in the Standard allow considerable latitude of interpretation in such matters, and because most judges of poultry are not as particular about shape of body as they are about color and other superficial points.

Fanciers and writers who make a fetich of following the Standard often protest against breeders following their own ideas in this way, but most practical people take the view that good breeding consists in making your stock to fit your requirements, and that it is of more importance to keep all the different breeds and varieties as nearly as possible to the most useful form for their class than to depart from that form just to make the breeds different.

Generally speaking, it is a question of following the prevailing style rather than of strict interpretation of the Standard. The farmer who wants well-bred stock for market poultry and eggs can select within the general-purpose class any variety he chooses, knowing that if he prefers that variety, but would like to have it a little different from the Standard, or from the popular style, he can either buy stock that has been bred the way he wants it, or can in a few years make it from such stock as he can procure.

Thus if a farmer likes a rose-combed white fowl with Plymouth Rock shape, — a little larger and longer bodied, and higher on the leg than the White Wyandotte, — it is a very simple matter for him to breed from White Wyandottes that approach what he wants until he has a strain of White Wyandotte of the type he likes. There is no disadvantage in his doing so unless he wants also to exhibit and to sell exhibition stock. In that case it is a matter of business policy to follow the prevailing style.

Although the general-purpose type is the one that best suits most farmers, many keep fowls of the smaller and more active laying type, or of the heavier meat type, either from personal preference or because they are specializing in a line to which one of these types is better adapted. Thus we find farmers in localities where special attention is given to growing large roasting chickens keeping flocks of Brahmas to supply eggs for hatching to those who make a business of growing this class of market poultry, or perhaps to engage in it on a limited scale themselves; and in parts of New England that ship eggs to New York City many farmers keep Leghorns or some other breed of that type to supply the white eggs which that market prefers.

As a rule, Brahma stock used by farmers is considerably below the Standard weights for exhibition Brahmas, and would soon degenerate to medium size if large birds from fanciers' flocks were not frequently introduced, for general farm methods are not favorable to the production of fowls as large as Standard Brahmas. To produce such size we must both breed from large birds and keep the growing chickens in small lots and feed them heavily while giving them ample opportunity to range as much as they want to. Large fowls are just as good layers as small fowls when managed right for that purpose, but it requires much more skill on the part of the poultry keeper to keep the large birds in good laying condition, hence their adaptability to farm conditions is limited to the farms of measurably expert poultrymen.

Leghorns as usually bred cannot be used for table poultry to the same extent that the heavy meat breeds can be used for egg production, but by keeping large Leghorns and systematically breeding to maintain good size, a farmer to whom it is an object to keep fowls of that type can get a great deal of very good table poultry, — quite as good, indeed, as is usually obtained from flocks of undersized fowls of one of the general-purpose breeds.

With so many breeds to choose from, and with the possibility of making modifications, within reasonable limits, in breeds and varieties that he may like better than others, though they are in some particular not just what he wants, the farmer now rarely resorts to the practices of grading up mongrel stock and crossing pure breeds which were once so common. But among farmers as among all poultry keepers the idea that the characters of a thoroughbred race are so surely established that they reproduce themselves unfailingly is very prevalent, and, as a result, they do not give as much attention to the preservation of the quality of the thoroughbred stock they secure as is necessary to prevent deterioration. Then the poultry keeper is apt to think and say that the breed has run out, or that the stock he bought was weak or not as well bred as it appeared to be. So, as in the old days when crossing breeds was common practice, he plans to remedy the trouble by changing breeds or by buying stock from another source.

If the stock has deteriorated very much it is usually better to bring in new blood; and when a change is to be made it is a good time to change breeds if there is any reason other than the supposition that the breed as a breed has gone by, and that it is therefore useless to try to get satisfactory stock of that breed. But neither new blood nor a new breed will permanently benefit the poultry keeper who does not realize that, whatever stock may be when he gets it, its quality and the merit of its offspring in later generations will depend upon his success in breeding to maintain type and quality, and in growing chicks to secure the full development of their inherited qualities.

To be able to grow good chickens is the first requisite in breeding good fowls. One may be able to grow good chickens and yet not be able to breed them; but if he cannot grow them right, all the theoretical knowledge of breeding in the books will be of very little use to him, and he cannot even tell whether he is applying principles properly or not. Growing good chickens depends partly upon having the right kind of good, vigorous breeding stock, but as much or more upon the conditions under which the young stock is kept and the care that it receives. No matter how good the breeding stock is, if the young are reared under unsuitable conditions and given indifferent care they will not thrive and develop as they should. On the other hand, if stock has not deteriorated too far, good conditions and good care will often work in a single season wonderful results in bringing its progeny back to the former higher standard of merit.

On farms good general conditions for growing chicks are almost always easily provided. When the conditions are unsatisfactory in any particular it is usually because the farm is adjusted to a plan of caring for them which does not meet fully the requirements of growing good chickens. The farm almost always has abundance of land room for all the chickens grown on it, but it is not always possible to so arrange the work of caring for the chickens that the advantage of abundant land can be fully utilized. In all the work with poultry on the ordinary farm the labor problem is more difficult than the land problem. The labor problem takes some troublesome forms. In some ways it is more troublesome when the care of poultry devolves on some one who gives most of the time to other work than where some one's entire attention is given to the poultry.

The tendency on most farms is to congestion of fowls, old and young, near the house or outbuildings where they can be watched better than elsewhere, and fed at the convenience of the person who has them in charge. The general rule in feeding is to feed rather short, which may not be a bad plan if the chicks are fed often; but if there are long intervals between feedings, and frequent irregularities and omissions, the young stock does not get as much as it needs to make its best development. Growing good chicks on the farm as elsewhere depends upon doing all that is necessary to bring out the best that is in them, — not cutting corners wherever possible and coming out at the end of the season with a lot of young stock that is only fair in quality. I would not say that every farmer ought to do all that is necessary to grow really good poultry, for I realize that not every farmer can arrange the work so that this can be done without interfering with work that must be given precedence to it. But I do say that if a farmer is to breed poultry in the true sense of that term he must grow the stock that he uses for breeding stock as well as it can be grown.

Not a few of the best breeders of exhibition poultry are farmers, and the farm offers by far the best advantages for the breeder of that class of stock; but we are considering here only the breeding of poultry for farm purposes. For these it is not necessary or desirable to give particular attention to breeding for the superficial, and often trivial, points upon which decisions may turn in close competition in the show room. As has been shown, the farmer may modify the type of his stock to suit his ideas and purposes. Still, if he is breeding pure-bred stock he ought to know the standard requirements for it, and keep as close to them as is consistent with his purpose and needful to secure a pleasing uniformity in the flock.

Most inexperienced breeders, and many who have been trying to breed poultry for a long time, think that the quickest way to get a flock of superior general quality is to produce them in large numbers, and so have more to select from. This is true only when the large numbers come from carefully selected ancestry. Many who wish to breed as good quality as they can, think that by being careful in the selection of males they may be less careful in selecting the females, and still keep up quality. That is true in a measure, but if one is looking for the best results he must be just as careful to use only good females as to use only good males.

On the farm only a small part of the flock of fowls is really needed for breeding purposes; that is, all the chicks required may be produced from a small breeding yard. But the common practice is to breed from the general flock, trusting to the use of the best males to improve or preserve the qualities desired. The principal reasons for this one-sided selection are the inconvenience of keeping a small breeding flock separate, and the advantage of hatching all the chicks for the season as nearly as possible at the same time. That this is an advantage cannot be denied. It is equally certain that to get it there is a great waste of the breeding value of the best birds in the flock, for if all the chicks for the season are to be hatched within a month, that means that only a small proportion of the eggs of the best hens can be incubated. Each farmer must determine for himself whether it is better to grow the chickens to come to maturity together than to extend the hatching season and produce only from the best of his stock, so insuring that all the chickens are well bred.

NATURAL INCUBATION AND REARING OF POULTRY.

CHARLES E. ALLEN, ABINGTON, MASSACHUSETTS.

For those who carry on the poultry business on a large scale, and who must have large numbers of chicks while it is yet winter, and before it is possible to secure broody hens in substantial numbers, artificial incubation is a necessity. There are thousands of persons who do not care for early chickens, and, in fact, do not hatch their chicks before April and May, who appear to believe that the spring hatching of one or two hundred birds necessitates the use of artificial means. Many of these may be influenced by the desire to employ up-to-date methods, renouncing the hen as obsolete and altogether undesirable for use in the production and care of chickens. They frequently express themselves as being averse to being "bothered" with hens, and say that their experience with them has been unsatisfactory. They do not tell us of the physical condition of the hens, the circumstances under which they are expected to do their work, nor the quality of the care which they receive. An investigation of the methods of these persons would probably reveal the fact that the hens are placed in poorly constructed nests, in unsuitable locations, where they are subjected to the intrusions of other hens or to disturbance by animals or human beings. While a certain degree of success may be realized even under such adverse conditions, the chances are largely in favor of failure, partial or complete. It is a peculiar fact that poultrymen are usually willing to spend considerable sums of money for an outfit for artificial incubation and brooding, but appear to be averse to spending a reasonable amount for the natural incubation and care of the chicks. It is apparent that justice to the hen demands an expenditure sufficient to enable her fairly to compete with artificial methods.

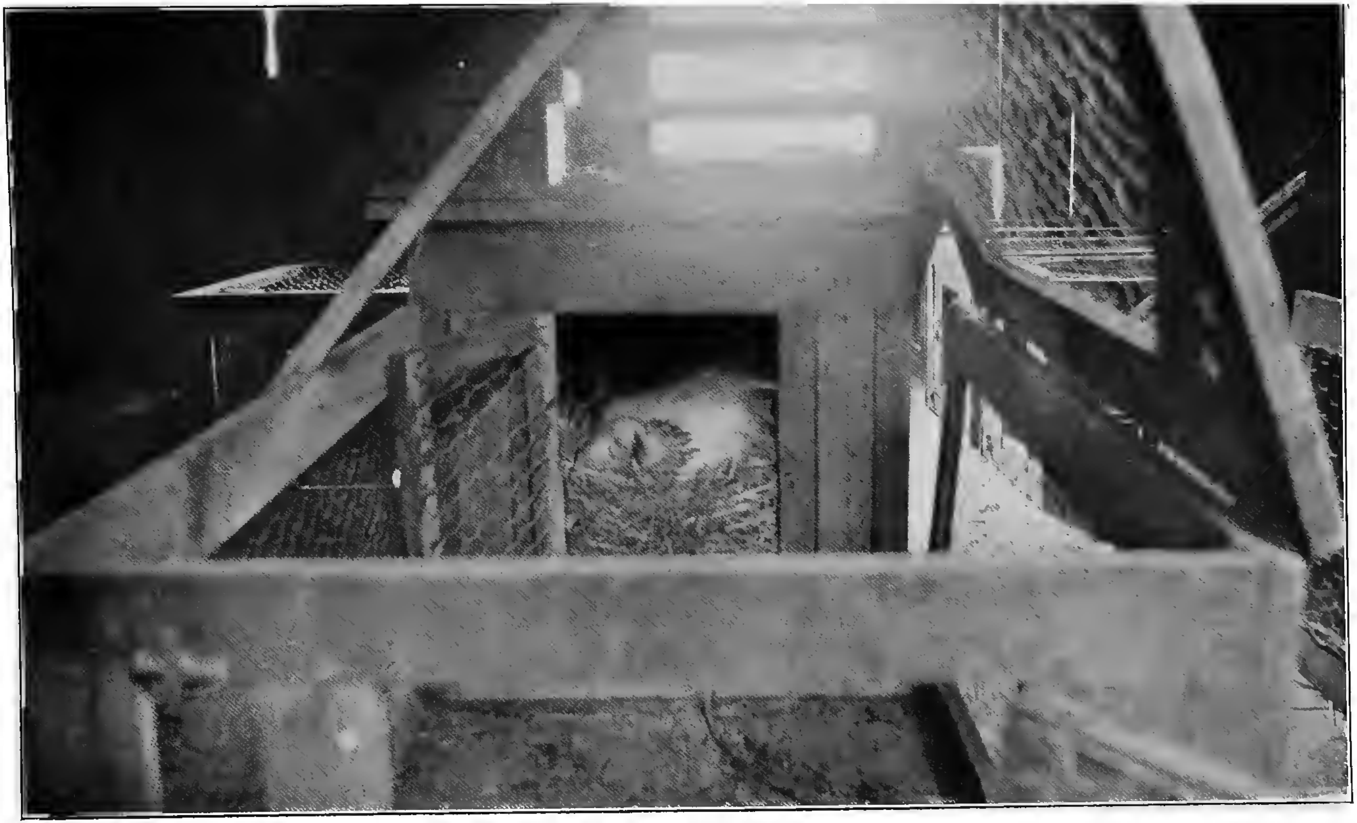
It is conceded by all that a hen which steals her nest is apt to appear, after a period of absence, with a large brood of healthy, husky chickens. If a careful search reveals the place where she was hidden, the probability is that but few, perhaps none, of the eggs are found unhatched. Where hatching is done by hens the conditions must, of necessity, be more or less artificial. The farther the conditions provided are removed from the natural, the greater the likelihood of unsatisfactory results. It is obvious, therefore, that it behooves one who would attain to anything like success to study the natural conditions under which the best results are attained.

We say that a hen "steals" her nest. This expression implies stealth, secrecy and the succeeding weeks as a period of privacy, solitude, — a state of seclusion. Her domestic instincts expel the social proclivities. She desires to be alone. Close proximity to others, even of her kind, annoys her, and, if she is inclined to be nervous, any disturbing influence aggravates this tendency. Under these circumstances our first and most important attempt should be to secure a secluded location for the prospective mother. It is apparent at the outset that he who employs a large number of hens as sitters cannot furnish in every case the secluded nook which would be most highly desirable. He must, however, do the best possible. Some of us have had experience with the so-called "natural incubator." We have constructed nests in convenient sections, with a suitable door to each section or division, which could be raised or lowered at will, have ranged these sections around the walls of a building, and have placed our broody hens therein, supplying the eggs when the hens had become wonted to their new location. At stated periods we have opened the doors of a portion of the nests and allowed the hens access to food and drink placed in the open spaces near their nests. When their appetites have been satisfied, and they have returned to their nests, the door has been closed, and the door to another section opened until the hens therein have in turn been fed and have returned to their nests, and so on until all had been served. Under these conditions we have found that in some cases a part of the hens did not return to their own nests, but would occupy others instead. We have been told that it was immaterial if they did exchange places. This may have been true, but whether true or not, there is a phase of the case which we could not ignore, namely, that while it seemed immaterial to some of the birds which nests they occupied, others were dissatisfied with any but their own quarters, and this dissatisfaction resulted either in their taking their position on the floor of the house, or in crowding in with a hen less particular as to her location, resulting in a quarrel, perhaps broken eggs, and, what was still further disastrous, leaving her own eggs to get chilled and rendered worthless. Another difficulty encountered was the liability of a general fight, precipitated by one quarrelsome hen, and becoming more or less general, at the end of which few of the hens were in a mood for further quiet sitting. Furthermore, this plan was found impracticable because of the time consumed if the attendant would prevent disaster.

After trying several different schemes the writer finally settled upon one which has given more satisfactory results than any other, and this is the employment of a 20 by 20 inch brood coop, with hinged cover, a connecting yard or run the width of the coop and about 3 feet in length, and having a hinged lid. The door to the coop is of a size convenient for the ingress and egress of the hens, which door is covered with chicken wire. In this coop the broody hen is placed at night with a few worthless eggs, and the door closed. When she has become familiar with her new quarters the door is opened and she is gently assisted into the yard for food and water. Sometimes she will return without assistance, but frequently she will need to be assisted once or twice. When, after two or three mornings, she returns without help, the worthless eggs may be removed and the good ones introduced. The door may then be left open, and she be allowed to leave or return to her nest at will. The attendant has little to do during the period of incubation except to supply food and water, remove the excrement from the run, and from the nest if the hen has fouled it, and to remove the remains of any eggs which may have been broken.

There is a distinct advantage in hatching in the same kind of a coop which the hen and chicks are to occupy when they are transferred to the open air, for then they more readily adapt themselves to the new conditions.

The preparation of the nest is of more importance than many persons realize. An improperly prepared nest is apt to result in an unnecessary breakage of eggs, and loss of young chicks by being trodden upon by the hen. While the adult bird is more intelligent than she is usually given credit for, it must be admitted that in some respects she exhibits less intelligence than could be desired. She will plant a foot upon a chick's neck, and though the chick cries lustily, it rarely occurs to the hen to lift her foot and thus liberate the sufferer. Under these circumstances it is desirable to reduce to a minimum the chances of such an occurrence. If the nest is properly constructed it will help very materially in this respect. Some advocate the use of earth at the bottom of the nest, maintaining that this causes a resemblance to natural conditions, as a hen likes to build her nest upon the ground. Unless the earth is kept moist the advantage is questionable. As to the material of which a nest is made, shavings or other fine material is objectionable, as the eggs are apt to be buried, and thus fail to get the proper degree of heat. On the other hand, coarse straw should be avoided, as giving a too free circulation of air under the eggs. For the due conservation of heat and at the same time a proper circulation of air, it is doubtful if any material can be employed superior to English hay. This lends itself to a use which is distinctly important, as will appear directly. The hay should be spread evenly over the bottom of the coop to the depth of 2 or 3 inches, care being taken to pull it well apart until no bunches or strands remain. More hay, treated in like manner, should be pressed down around the outside of the coop, particularly into the corners. Then all should be carefully arranged so that the entire nest will have the form of a shallow bowl, after which wisps of hay should be twisted into loose ropes about 3 inches in diameter, and pressed down firmly around the entire circumference of the nest, the space in the center being made to conform to the size of the hen. These ropes serve to prevent the eggs from rolling out of the nest. Another great advantage in a nest so constructed is that as soon as the chicks are hatched and dried, these ropes should be carefully removed, which will leave the nest nearly level, thus allowing the chicks an opportunity to venture gradually into



Coop and run for setting hen. Cover of run raised.

the space surrounding the hen, returning as they choose. It will be seen that under these conditions there is much less likelihood of their being trodden on and killed by the hen than when the nest is much lower in the center, in which case the tendency is for the chicks to gravitate towards that center. The chicks may thus remain safely in the coop for forty-eight hours, during which period they should receive no food, and after which they may be removed to a like coop out of doors. Into this coop earth should be placed to the depth of an inch or so. It is not necessary that this earth should be dry. On the other hand, it is preferable that it be distinctly moist. As an experiment I have removed chicks to the outdoor coop as soon as hatched, and before the later-hatched ones were dry, placing in the coop very moist and partially frozen earth, and I have never had chicks do better. It may be borne in mind that a chick's feet and legs are not sensitive to cold, but that their backs, near which the vital organs are located, must be protected. The sight of chicks in inclement weather with their feet and legs exposed while brooded by the hen is not unfamiliar to those who have practiced early incubation. They may be allowed to run about in a light snow, or upon the crust, without the slightest disadvantage.

When the chicks are removed from the hatching coops, the coops to which they are removed must be provided with more extensive yards or runs than those used during the period of incubation. If the brood is not allowed free range, these runs should be at least 4 by 6 feet. As soon as the hen is transferred to the open ground she scratches most enthusiastically, and if the run is small the hen is apt to throw the chicks violently against the sides of the inclosure. There is the further danger of the chicks being buried in the earth which the hen throws up. I have found, at night, as many as six or eight valuable chicks in a single litter so buried. Provided with a larger yard, the chicks have room to avoid the results of the mother's activities.

After a few days the yards may be raised a few inches at the end farthest from the coop, and the chicks allowed to range. Where this is done the coops and runs must be removed from one another far enough so that the chicks will not mingle with other broods and enter the wrong runs, in which case the hens will show their displeasure in a most discouraging manner.

It is the practice of some to continue the confinement of the chicks in the runs for an indefinite period, but in such case the runs should be moved every day or two on to fresh grass ground, so that the chicks may be provided with plenty of green material. When they have been weaned, and have attained to considerable size, the coop may be removed, if the weather be warm, and the necessary shelter from the rain be provided by covering a portion of the coop with tarred paper or other material impervious to water. Under such conditions the young stock will be comparatively safe from enemies, and will do very well until they have grown to considerable size.

It may not be amiss to make some observations relative to the choice of a hen for incubation, and her care and feeding during the period of incubation.

In my experience it has not been unusual for one hen to hatch every fertile egg, while the hen in the next coop hatched but one or two, or possibly none at all. This last condition may be the result of any of several causes. First, the hen may be in poor flesh and unable to generate and maintain the necessary heat. It is well, therefore, to select hens for incubation which are reasonably fat or plump. Second, the hen may be nervous. If she is allowed to leave the nest at will she may spend much of her time off the nest, and if the weather is cold the eggs will be chilled and the germ killed. If she is confined to the coop the situation is not greatly improved, for she will frequently be found standing, and may by scratching destroy the nest and eggs. Third, she may show a disposition to roll the eggs out of the nest, and thus destroy them. This last disposition can be discovered only by testing her, while the preceding difficulties may, in a measure, be determined in advance. Whatever the cause of non-success, there is a presumption that it will continue, and a hen which has once proved herself a failure should be banded, and excused from further service in this direction. On the other hand, a record should be kept of good sitters and mothers, and these may be employed in the future.

There is a considerable variation in the different sitting varieties. The White Rocks, while frequently excellent sitters and mothers during the warm months, are not dependable early in the season. The Barred Rocks are less apt to be nervous than some of the other varieties, and have the advantage of storing up large quantities of fat, which is utilized during the period of incubation. Their maternal instincts are, perhaps, not quite so well developed as in the Rhode Island Reds. I have had one of the last-named breed wean her chicks at almost too early an age, steal a brood from a Barred Rock hen, and gratify her maternal instincts by rearing the stolen chicks. Still, I have had considerable difficulty from nervousness in this breed, and have noted a tendency to get thin before the hatch was completed. I have been more successful with the Brahmas than with any of the other breeds mentioned, but others may have had a different experience.

While we have been told that a hen should be disturbed as little as possible during incubation, I usually make a practice of talking to and quietly handling my sitting hens, particularly those of my own rearing, unless they show a decided tendency to nervousness. Few birds fail to respond to kind treatment, and when they do, they regard the attendant as a friend to their chicks, when hatched, and do not exhibit the fear which invariably results in wild chicks.

During incubation the hen's food should be almost entirely composed of corn, either whole or cracked. This helps to keep the hen in good condition, and to furnish the requisite heat. I have had a hen, immediately upon removal from the hatching coop, attack her chicks, and eat one or more of them ravenously. This suggests the need of meat, and the probable advantage of feeding a reasonable quantity of it during the last few days of incubation. Grit and oyster shells should, of course, be supplied during the entire period.

Of course the use of some good insecticide is indispensable during the period of incubation. Many cases of extreme nervousness may be cured by the free use of lice powder, applied at intervals while the hen is sitting. Soon after the chicks are hatched a small piece of lard, well worked down to the skin at the top of the chick's head, is a wise precaution against head lice.

While many breeders decline to submit to the annoyance of natural incubation, there are certain advantages which unquestionably compensate for the trouble and necessary attention to details. Where chicks are hatched by the natural method, and treated as hereinbefore suggested, leg-weakness will be practically unknown. While this method will not entirely eliminate white diarrhœa, it reduces the chances of infection from other chicks. Hen-brooded chicks obtain more exercise than those artificially reared, and hence are stronger. The supply of a greater variety of food, and the larger number of bugs and worms consumed, by reason of the activities of the natural mother, tend to induce a more rapid growth. Natural incubation and brooding furnish a gloss and texture to the feathers invaluable to the fancier. The danger of mortality resulting from sudden showers, where an attendant cannot be near them all the time, and from various diseases to which chicks are subject, is reduced to the minimum. Unquestionably a much larger percentage of hen-reared chicks attain to maturity than when artificial methods are employed.

It is difficult to excel Nature's methods in incubating and rearing chicks, where those methods are supplemented vith patience and proper attention to details on the part of the attendant; and it may be truthfully added that he who lacks in patience, and abhors details, has no rightful place in chicken incubation and rearing, either natural or artificial.

BREEDING AND SELECTING FOWLS FOR EGG PRODUCTION.

JAMES E. RICE, PROFESSOR OF POULTRY HUSBANDRY, CORNELL UNIVERSITY, ITHACA, NEW YORK.

The burden of my song to-day will be the efficiency of the hen, but before entering upon the discussion of this subject I want to express my appreciation of the honor and the privilege of returning so many times to speak before your State Board of Agriculture. I think that we have made wonderful progress throughout this country in very recent years in agriculture. We have made greater progress, in my judgment, in the past ten years than in the preceding hundred years, and that is saying a great deal; and truly, poultry husbandry has for one reason or another, come out of the realm of a side issue or a one-person business on the farm, and has now become a well-established commercial enterprise worthy of the best men and worthy of capital and confidence in the business. In other words, because of our increased knowledge of how to successfully handle poultry enterprises, poultry husbandry is not now, in my judgment, to be considered as one of the risky, hazardous occupations, but one of the well-established, conservative and profitable occupations. As an evidence of this fact we can point literally to hundreds of farms in New York State and in Massachusetts, and literally to thousands of them in the United States, where 1,000 or 2,000 hens or more are being kept profitably, and more profitably than most other branches of agriculture that could be followed in those same districts. I was talking with one of the most successful farmers in our State a few weeks ago, a man who has been so successful that his two sons have been trained especially for farm work and are back on the farm, in partnership with him; a man who has such a big farm and is handling it so well that he has 11 miles of tile drains on his farm, and who grows many acres of many crops, and who keeps careful accounts, and I asked him the question, "Which branch of your farming do you look upon now as being your most profitable, permanent, reliable, staple standby?" He answered, as quickly as he could get the words out of his mouth, "Poultry and asparagus." Now we cannot get behind those facts; we cannot, in any way, question those statements when men of substantial means and intelligence, men who are capable of handling any branch of agriculture that their fancy happens to take or that the market conditions would warrant, take a position of that sort. A man walked into my office a few days ago, as he has done now for five years in succession, either at Thanksgiving or Christmas time, and laid down on my desk an outline, a financial statement of his poultry enterprise, — a city man with a city wife, who had wanted to get away from the worries of city life, and, having enough means, bought a farm and went into the keeping of poultry. When I saw them branch out into the poultry business I had some misgivings because so many persons have gone into the breeding of poultry who have spent money unwisely and have made failures which have reflected upon the business generally. But at the end of the year, when they came to the college again and showed me the number of eggs they bought, the number of chickens they hatched, the number of eggs they had received in a year and other items of expense, all accounted for, I found they had made the best record of anybody who had ever laid down their accounts before us, and they continued to do it every year right straight along; they have not met their failure yet. This year they reared 94 per cent of all the chickens hatched, and they have not reared less than 92½ per cent in the years they have been in the business. They had an average egg production of 133 eggs per hen and 165 eggs per pullet, this past year, for their entire thousand birds.

This man showed me where he had made $2.81 net profit for every one of those hens as his labor income, after paying the interest on the investment and every cost, including labor that they hired, and had made a profit this year of $2,700 and some odd cents from his chickens.

Is he going to keep 2,000 and make twice as much? No.

He is well satisfied to keep what he has and take perfect care of everything he has and make the maximum income per individual. Now, it would take several days to discuss the factors that entered into that man's success, but one of the things that I think has been paramount in his success was the fact that he knew good stock when he saw it, and has bred and handled his fowls with respect to the efficiency of the individual; and that is my text to-day.

BREEDING.

With all due respect to the importance of every other important thing in handling poultry, — the feeding, the housing, the incubating, the brooding, the marketing, which are big, strong, important connecting links, — I must say that I feel positive that there is one link that must be stronger than all of the others, and that is the breeding of our poultry. Why? Because everything depends upon the efficiency of the birds that we are handling. If the birds are not what they should be as regards vigor and productivity and productive power, — production of fertile and hatchable eggs and eggs of high quality, — if they are not capable of making use of all of the other factors that we may supply we never can get our reward. Poor hens will not pay in any kind of a system of housing or upon any rations or by any methods of incubation or brooding, nor can we reap our reward by any system of marketing. On the other hand, if we have good, efficient machines to utilize this food, to utilize these buildings and the other facilities that we can provide, frequently a man will succeed if he has not done some of the other things as well as he should, because the birds have been able to manufacture products economically. So I emphasize that we must begin with the foundation principle, that, whatever else happens, we must have the very best stock that it is possible for us to breed and handle. This is particularly true now, when the high cost of feed makes it absolutely certain that a man cannot make money unless he has got good birds, and makes it absolutely sure that he is going to lose money if he has inefficient birds. There is only one blessing coming out of a high food cost situation, as I see it, except to the man who is selling the feed or growing the feed, and that is the fact that it is going to force people to cut down the number of birds they have got on their farm and keep only the good ones. If it accomplishes this purpose it is going to mean almost a revival of the profitableness of the poultry business.

Another factor looking in the same direction is the high cost of labor, and you people in Massachusetts know better than we do over in New York what it means to compete with the munition factories and other mercantile concerns that are pulling labor from your farms. This means that we must reduce to the lowest number the birds we have, and every one must be a good one, and then increase them as rapidly as we can up to the full capacity, every one a good one. Our objects in breeding should, first of all, be to secure birds that will live, — birds that will have high vitality and will live with us for many years. The greatest weakness of our business is the fact that the bird is a short-lived individual, comparatively; that she is a small individual as compared to other kinds of live stock; and therefore it becomes important that we breed our birds in such a way that we are not going to lose even 3, 5 or 10 per cent mortality or more per year and have to replace them. It means that when we find a good bird we must be able to keep it for a period of several years for breeding, to establish that factor of a long-lived race. It means that we must have birds that inherit a tendency to produce, an inborn tendency to lay or to grow meat, and to do this better than the average. It means that we must breed those birds to produce a high-quality egg, because the quality of an egg as to its size, color and shape, as well as the number of eggs she lays, is going to measure the money-earning power of the bird. It means that we must breed those birds so that they are going to lay their eggs when they will give us the highest price rather than mere numbers of eggs or quality of eggs. So we have a number of factors there, including also fertile and hatchable eggs, coupled with constitutional vigor, in order that we may reproduce our flocks and get as good or better every year. Those are the main cornerstones of our breeding program.

Now, coming to specific problems, the next step is that we shall have an ideal; that we shall know what we are breeding for; that we shall have clearly fixed in our minds the difference between good birds and poor birds when we see them, and a person can never expect to make progress in the breeding of poultry if he just has blindly the number of eggs that a hen has laid as his guide. He must have pictured in his mind the kind of bird that will make the profit, and when he has got that ideal he will compare every other chicken with that as his standard, and this standard must be high.

Then he must have a definite procedure in breeding, and the next step in that procedure is that he ought to start where the other fellows left off, rather than to begin at the bottom and have to work up. That means that he should start with some good, pure breed, and he ought to start in a small way rather than in a large way, because if he starts in a small way it does not cost him very much to get a few good individuals, and by waiting a year or two to get his full capacity he will grow and produce from these few and sell them to himself at high prices instead of undertaking to buy himself into the chicken business. Now you will notice that the people who usually fail are the people who have a lot of money and little experience to begin with, and they nearly always undertake to buy themselves into the chicken business from somebody else instead of growing into the chicken business by their own efforts in hatching and rearing and breeding.

Having decided upon our breed, be it Plymouth Rock, Leghorn, Rhode Island Red, or whatever it may be, how shall we know a good bird from a poor one, male or female, when we see them? Now the last word has not yet been said on this subject, but enough has been known and discovered in the past few years so that we are able to tell, with most sensational accuracy, good birds from poor birds when we see them as regards their productive power; and to do this so early in their lives that we can eliminate the poor ones and keep the good ones for the next several years of their profitable lives I want to try to point out to you the differences in at least four or five characteristics between good and poor birds. Fortunately for us there are certain physiological changes, certain external characteristics in our birds, because of their nature, that vary from time to time during the year, and if we understand why they have occurred and what caused them we will be able to have an insight into the meaning of the thing so that we can read on the outside of the bird what is going to take place on the inside of the bird.

This means that to-day we have a means of improving the quality of our poultry that has never been known before in the ages, and is making it possible for us to now breed our birds as intelligently and as scientifically, nearly, as the man can who has larger kinds of live stock. The great difficulty that the poultryman has had to confront in all these ages, and the thing that has held back the advancement of poultry breeding throughout the country more than any other one thing or all others put together, has been the fact that it has been necessary for us to breed our fowls with regard to their production by flock methods and by flock averages rather than by individual merit. What I mean by that is this, that when a man has $100 invested in hens he has about 100 hens; when he has $100 invested in cows he has only one or two individuals; he can mark and he can know the parentage and the offspring of his cattle, of his sheep, of his horses and of his hogs, but not of his hens. He has known a certain male with a flock, and he has only known that the chickens came from any one of 15 or 20 females, because he has not been able to connect the responsibility for high production or low production with both parents or either parent, and as a result the continuous breeding sometimes of a low line with a high line has held us to averages, and it has only been a gradual and very slow process upward. But with this discovery of certain externals which give us an idea of what is happening inside, we are able to winnow out the good birds from the bad. We can do this without the laborious expense of a daily trap nesting, which has been practically prohibitive because of the fact that it costs in the neighborhood of 50 to 75 cents a year per hen, and it is only here and there that a person has been venturesome enough to undertake the expense and to keep it up. With this method that I am going to try and make clear to you, we only need the trap nest during the months of September, October, November and December, if we have hatched at the proper time; and as a matter of fact, for the use of many farmers and poultrymen it is not absolutely necessary to have the trap nest at all, as we can certainly make rapid progress by merely judging the birds on their externals. We must realize, of course, that no physical examination of any individual, be it a race horse or a cow or a hog or a sheep or a hen, will always be absolutely correct in predicting the best or the poorest individual, but it will be sufficiently accurate so that, for all practical purposes, a man can eliminate from his flock the unprofitable birds and can keep only the profitable, and can also distinguish between the more and the less profitable.

Points in Selection.

I am going to pass very rapidly over the first step in the selection; after having decided upon our pure breed, it is to recognize those characteristics that indicate the vitality of our offspring or of our stock. We must have good stock to begin with, — strong, healthy, vigorous stock. It is an inherited characteristic to be born weak or strong, and occasionally a bird that is born strong becomes weak by misuse, but whatever the cause may be, it is important that we get rid of any bird that shows weakness at any time in its life from a baby chick up.

As regards the general body shape of a weak chicken you will find that the body usually lacks capacity where there is low vitality; that it has a very tucked-up and rather contracted abdomen; it has a tendency to be hollow-breasted, angular, ungainly and loose-jointed in its make-up. Whenever an individual becomes weak while growing, nature seems to direct its growth towards the enlargement of certain parts and the dwarfing of others. If any part of a weak chicken grows it is its head and beak and feet, and occasionally its wings, at the expense of its body. So you will find a tendency to a rather thin head; a long, thin, flat beak; a rather long, thin neck; thin body; long, thin shanks, legs and toes, and a very poor development of plumage; a sunken, dull eye; a drooping eyelid; a small, pale comb, — all of those external characteristics that indicate poor health, low vitality and a poor appetite. In other words, the bird of low vitality has a weak development of the breast and a poor development of the abdomen, whereas the strong-vitality bird is strong in those points. Now, if you would compare each of those birds with a triangle you would see that the weak bird, because of its shape, has a tendency to narrow at the shanks, whereas the strong bird has less of a tendency to the triangular form. We say, therefore, that comparing each of the breeds, of course according to its type, with individuals within that breed the birds of high vitality are those that more nearly approach the parallelogram form than the triangular form, and this is as true of baby chicks as it is of mature fowls, either male or female. If one will get those points fixed in his mind he will be able, with a great deal of accuracy, to eliminate early in the season all of the low-vitality chickens in his flock, sell them alive at whatever he can get for them, and keep only the stronger and more robust individuals in his flock. A person ought to select early in the development of his chickens a few of the strongest, most rapid growing, best birds for future use as breeders, because occasionally birds that do not grow well during the early part of their lives, after they once get well feathered out are more difficult to detect than they are at early stages in their development.

At the college plant last year we selected three lots of white Leghorn cockerels on the basis of the characteristics which I have pointed out. Then we started a series of observations to find out whether there was any difference in the actual breeding value of these three groups, and so they were placed in pens of hens. We had a bunch of 43 white Leghorn hens in pens, and men were stationed in those pens for regular hours during the day. The males were colored with different diamond dyes and the females were marked with different colored paints on their wings, with marks and numbers, and the actual number of matings that took place was recorded to see what the difference in the efficiency of these birds was, based on external characteristics in selection.

This shows that a man must be as discriminating in the selection of his males as he would expect to be in selecting his females, with regard to vigor and productive power, and just because of the fact that you can be more discriminating with your males makes it all the more important why a person should be. Out of 100 males that a man produces he can eliminate and sell all but about two or three, or four or five; in other words, he has got 95 per cent more selecting power to get good ones and only good ones, whereas with the hens he cannot reduce them to that extent. He has to keep about 15 to 20 hens for every one male that he has selected; therefore he can be more particular about the quality of his males than of his females. 'I do not know anything that is more inspiring, I do not know anything that is more worth while, or anything that will tie a man to his business better than to get right into the flock and study those chickens and reduce them by a process of elimination each day or each week as the time comes to sell, throwing out the undesirables until, in the fall of the year, he has a choice bunch of cockerels that money could not buy. And I want to say right here that if a person has not got the love for the business and the love for the stock that will lead him to go in there and help to pick out those birds to fit that ideal that he has established, he never can hope to succeed in the poultry business.

The next step in the selection for breeding is to get uniformity as nearly as possible in the stock that we rear, as regards eggs. We have been making quite a good many studies of the effect of time of hatching on the ultimate producing power of the birds, and you would be surprised to see how such an apparently unimportant matter as a few weeks in the time of the year when the chickens are hatched will affect their ultimate productive value. In other words, it is not simply a question of knowing from which hen or which male our chickens come; it is also a question of knowing when we use those eggs for hatching, — whether it is in March or in April or in May or in June, or earlier or later. And would you believe that, taking the same hens absolutely and hatching their eggs from February on through to July, you get an entirely different result in the laying of those birds for the first year, and frequently also in the next years, due not to the hens or the males, but just to the time you hatched them. A man has no right, therefore, to expect to get the best results until he has learned for himself, with his own breed and in his own section of the country, as to when he should hatch, and that will depend upon the altitude and latitude and the kind of breed he has. Some breeds develop more rapidly and some less rapidly than others. At the college farm we made observations on three different hatches, — one early, one medium and one late. Whenever a bird began to lay, a mark was placed in the square opposite her leg-band number, and this was continued every day straight throughout the three hundred and sixty-five days that followed the beginning of the observations early in November. About two weeks after the first hatch began to lay the first individual in the second hatch commenced, and about two or three weeks after the second hatch began to lay the third hatch commenced, and by the time the first hatch had all begun to lay nearly all of the second hatch, but not all, had commenced to lay, and in the course of two or three weeks more all of the third hatch had commenced to lay. In other words, the chickens hatched two or three weeks apart in the spring began to lay two or three weeks apart later on in the fall, and so there was a succession of eggs from each of the hatches coming on in about the same proportion as the difference in the time that they were hatched. In other words, we have a new crop of pullets coming on to lay, giving us a new lot of eggs, and these birds that were hatched very late, and therefore did not begin to lay until very late in the fall, had a little tendency to make it up the following spring by laying a little at that particular time when they once got under way, but they did not make up their lost time, and they could not possibly ever make up the handicap in money value that these pullets of the first hatch and the second hatch made by laying eggs in November and December, when they were so scarce and so high.

Our recommendation naturally is that the policy ought to be to have the pullets hatched at such a time that they will lay the most eggs in the first year, and give us the largest possible number in periods of high prices, and we have worked out that for Leghorns in central New York, under our methods of feeding and rearing and handling, there is a time when we can get our largest net yield from those birds, and that is between the 15th of April and the 15th of May. In that length of time we should hatch the bulk of our Leghorns and Rhode Island Reds. With Plymouth Rocks that season ought to be probably just a little bit earlier, because they are a little slower to develop, and the principle involved is this, apparently, that we need to hatch the pullets at such a time in the spring that they can be reared in cool weather; that we can get maximum fertility and hatching power; that they can get their start and get well feathered before the very hot weather comes on; and that they can reach the laying age, which is about six to eight months, so that the first pullets that lay shall be in their winter quarters and comfortable, and flocked and at home and contented before they lay and before cold weather hits them. If we get that combination they begin to lay in the fall and go through with scarcely an evidence of moult, and give us our largest maximum yield the first year, and are likely to go along and do the same thing for two or three years.

If, however, we have hatched them too early in the spring, then they lay too early in the summer, moult before the fall weather comes on, and they do not give us good production at that time. If we hatch too late, in June, for example, or later, they do not get their full pullet plumages in time to get well feathered and ready for laying in the winter, and they do not lay until towards spring. But what we ought to do is to be medium in this matter; get the bulk of our chickens at the time they will do the best for us, and then hatch a few perhaps a little earlier in order that they may give us eggs before the other pullets have begun and after the hens have mostly ceased; that will enable us to hold up our production, even though we know that they are not going to lay well later in the winter. There is another reason why it is important that we know something about the ages of our birds, and I think we ought to identify them, if possible, either by putting the pullets that are hatched at one time off in certain houses, or marking them so that we will know, in the fall of the year, at what particular time they were hatched.

It is well to hatch a good many at once, anyhow, not only to make it easier work to take care of them, but to be able in the fall to approximately identify them as to age, and you will see the significance of that in what follows. A pen of birds that were hatched on May 2 laid us 140 eggs the first year; those that were hatched on May 20, 142; those that were hatched on May 31, 118. We can expect to get our highest fall yield from pullets rather than from hens, and each year, as long as the hens live, they have a tendency to begin later and later in the fall to lay, and then to cease earlier and earlier the following summer, shortening the length of their laying year. Ultimately we find that hens, as they grow older, up to seven years or more, as we have them at the present time in our flocks, have a tendency to lay less and less eggs in the months of difficult production, — of cold weather, — and whatever eggs they do lay, to lay them in the months that are most favorable, — the months of April and May, — and I predict that when these birds have reached ten, twelve or fifteen years or more of age, as some of them undoubtedly will, the only eggs they lay at that time will be in the months of the natural breeding season, — April and May. The pullets lay heavily in the months of cold weather as compared to the production of the same bird in other years, and the tendency for the third year is to shrink away in the fall of the year. And yet all, whether they are hens or pullets, have a tendency to lay about the same number of eggs in the months of May and June.

Now the last step in our program is the matter of selecting our hens with regard to productive power by means of the way in which their external characteristics change throughout the year. The only way we can really understand the philosophy of this thing is to study the inside of a hen as well as the outside, to see what the relation of the characteristics is. Now, the hen lays her eggs according to a certain law of physical development. It is the perfectly natural, normal thing for a pullet to reach the age of sexual development and production at about six to eight months of age. Sometimes they develop abnormally early and are precocious, and then pullets have been known to lay when they were four months of age. I have had hens myself which laid at four months and four days. Sometimes they do not lay until they are nine or ten months old, and we have one hen that did not lay until she was three years old. She only laid three eggs that year, yet she strutted around and made out that she was quite as good as any of the rest of them; she was one of the modern aristocrats. Tests in the development of the oviduct and ovaries of chickens show that at three months old the oviduct is not more than 4 or 5 inches long, but the development is so rapid that at six months of age, when the pullet is not quite ready to lay but approaching it, there is an oviduct that is a foot and a half long and an ovary that shows yolks of the eggs that are the size of pennies, nearly the size ready to lay. At seven months the hen has taken on the appearance of full maturity in depth of body, size of tail and wings.

When a pullet is eighteen months old, just prior to the close of the laying period, she will begin to go back; her comb becomes smaller and paler; the wattles have shrunk up, her abdomen is contracted; she has not as full a crop and she does not have the activity. She is not as friendly. The pullet that is laying heavily is friendly; the pullet that is dormant is likely to be wild; and you will notice that as you study your birds about you in the pen as well as the change in their shape.

At the close of the first laying season the oviduct is not over 8 or 10 inches long, possibly a foot, whereas only a month or so before, when she was in full laying, that oviduct, without the egg being in it at all, would be 2 or 2½ feet long and greatly congested. In other words, the reproductive system of the hen changes inside of the hen each month of the year as she is productive or dormant, just the same as the udder of a cow is congested and full and large and active when functioning, or shrunken and inactive when she is not productive. Now this change of the reproductive system inside of a hen changes her shape. When this is large and full her abdomen is deep, and when she is laying she is eating a good deal of food and her crop is nearly always full, so that when she is active and laying she is in her best physical condition, and usually carries a good deal of surplus fat in her body; whereas the pullet or hen that is dormant usually has little fat, and the reproductive system is shrunken to its smallest size. We find, also, that whenever the reproductive system is active the external characteristics, the secondary sexual characteristics, the comb and the wattles and the ear lobes all change in accordance with the change that takes place inside; so much so that we can tell by the texture of that comb, by the way it feels, whether a hen is laying or not, with great accuracy, just because of the sympathetic development of these two functions, — the reproductive system in correlation with these external characteristics.

The hen that is in full moult is still more dormant than the other, ragged in plumage, dry in comb and with pale shanks, and she is in a physical condition of dilapidation, and so for at least three months of her life. That is not always the case with all hens; some hens have so much vitality that they go right on laying during their moult; others cease laying when they begin their moult. When the hen has moulted and begun to lay again her body is taking its new shape of activity and development of the deep abdomen; she has a different carriage, larger comb, brighter color and is now functioning again.

Now that discussion will perhaps serve the purpose of paving the way to a careful, systematic classification of these characteristics of the birds. There are four characteristics that we look for in the birds to judge of their productive power. The first is the texture of the comb; the color is worth something, but it is not as valuable as the texture. The size is indicative of productive power, but it is not as important as texture. Mr. Kent, one of our instructors, discovered this fact a few years ago in making his studies of the birds; that the feeling of the comb, as to whether it is dry and hard or whether it is warm and pliable and velvety and soft, indicates whether a hen is laying or not at the time the observation is made, and so we take five degrees of variation. No. 1 is oily and soft; that indicates that a hen is in a laying condition. No. 2 is very pliable; she may be just getting ready to lay or may have ceased laying for a little while. No. 3 is slightly pliable; this stage indicates that it is about halfway between the very soft, pliable comb of a laying hen and the dry, hard comb of a dormant hen. Then we have No. 4, quite hard, and No. 5, dry. hard and stiff, in the case of the dormant, moulting hen.

The second characteristic is that of the color of the shanks, and in the case of any of the breeds that normally have yellow shanks, — the Plymouth Rocks, Wyandottes and Leghorns, — when the hen is in full health and functioning, then we know that that color changes quite remarkably as to whether she has laid many or few eggs. By noting the degree of change in color of those shanks we can estimate quite accurately the productive power. There are five degrees in this change of color, — pink or white, cream color, lemon, light orange and orange, — so that when a hen of any of these breeds has been dormant for any length of time the color or pigment comes back until they are full color; whereas, if she has been laying a long while and has laid many eggs she has laid that color out.

The third characteristic is the color of the ear lobe. The Connecticut Experiment Station a few years ago discovered the fact that by noting the appearance and disappearance of color pigment in the white ear lobe of varieties of fowls that have that colored ear lobe, they could estimate whether or not a hen was laying, and, in a degree, how many eggs she had laid in a year, if observations were made at the right time. We have noted that characteristic among our four, and we classify each bird as to whether she has enameled white ear lobes, and if she does she is put down as No. 1; light cream color, No. 2; light lemon, No. 3; lemon, No. 4; light orange, No. 5; and this is so reliable in the case of pullets that if you go into a flock of Leghorn pullets and notice the color of the ear lobe alone, you can tell with surprising accuracy whether this pullet has laid a few eggs, or is just going to begin to lay, or has laid many eggs, or has not laid any eggs at all.

The last characteristic is the moulting characteristic, as to how a hen moults, particularly when she moults. We have defined five degrees of moulting. Go into any flock of hens and pick them out and undertake to score them on their moulting characteristics and you will find one hen that has not moulted at all, and another that is all through moulting, and then there will be gradations between those two which we have classified as follows: No. 1 is the bird that has not moulted at all; that indicates that she is still laying. No. 2, new body feathers 1 inch long indicate that she is starting to moult. No. 3, new body feathers 3 inches long indicate that she has started to moult still more heavily. No. 4, moulting nearly complete, and for a complete moult, No. 5.

Now, if a person will pick up a bird and score her according to the comb texture, the shank color, the ear lobe color and the moulting condition, without ever trap nesting his birds at all, and do this at the right time of the year, — in the months of September or October or November, when the bird is susceptible to all these climatic changes that cause her to cease to lay, and when only the good hens will lay, — he will be able to pick out and eliminate from his flock the low-producing birds with surprising accuracy. He can then keep the high-producing birds and classify them in those three groups, as I will show you from the figures that are to follow. I wanted, however, to get this point clear in your mind, so that you can go home and put this thing into practice, if you care to. Now remember that in scoring these birds the lower the score the bird gets the better she is; the higher the score she gets the poorer she is. Whenever you score a bird with those four characteristics, the highest possible score you could get would be 5 in each one of these, which would be 20; the lowest possible score would be 4; she would be 1 in comb texture, 1 in shank color, — that is to say, she would have 1 in comb texture, a very bright red and a pliable, soft comb; she would have 1 in pink or white shanks, indicating that she had laid for a long while and was still laying; if she had ceased to lay the color would have begun to have come back in her shanks again. An enameled-white ear lobe will count one, and if she has all her old feathers that also will count one. That score will show she is a high-producing bird. If, on the other hand, she had a very hard, dry comb, 5; orange-colored shanks, 5; if she had yellow ear lobes, 5; if she had completed her moult and had all new plumage, 5; you could put that hen down absolutely as a very, very low-producing hen.

To prove to you that this method of scoring birds works out in practice, I will give you the figures on three lots of Leghorn yearlings at the college farm which we scored in this way. We had trap-nest experiments on several hundred birds, and we picked out the twelve highest, the twelve medium and the twelve lowest producing birds, according to our office records. Now the egg records of these birds were 210, 207, 199, 198, 188, 188, 200, 208, 188, 193, 188 and 179; and on the points I have given you, — namely, comb texture, shank color, ear lobe color and moult, using the figure 1 for the best score on each point and the figure 5 for the poorest, — their scores ran along around 4 or 5, with only one bird scoring as high as 7. You see those were all excellent scores, and the egg records show they were excellent birds.

The egg records of the twelve medium birds were 136, 134, 133, 128, 127, 125, 122, 122, 120, 113, 111 and 110, and their score on those four characteristics was 6, 11, 6, 13, 9, 10, 13, 8, 7, 8, 6 and 12.

The egg records of the twelve low birds were 66, 59, 54, 52, 52, 50, 50, 41, 34, 2 and 0. Their scores were 14, 18, 14, 17, 14, 15, 10, 15, 16, 13 and 12.

You see that high egg records and low scores, medium egg records and medium scores, low egg records and high scores go together pretty consistently.

Now suppose a person agrees to go into his flocks at certain times of the year and select these birds with regard to the time they begin to lay and the time they cease to lay, as indicative of their productive power, using those characteristics that I have already pointed out to help him pick out the birds to see whether they are laying or not. Now I want you to get this thing clear, — that you do not have to observe these birds the year round; but if you will only observe the pullets during the fall months to see when they lay the first egg, and mark them, you will never need to observe that pullet again. You do not have to put the record down whether that pullet laid any time during the season after you have once put a band on her leg to know that she has laid in the fall. That is all you want to know. That is not a difficult thing to do. A person can do it by those characteristics that I have stated, with a great deal of accuracy, or, by putting trap nests and trapping them for that short length of time, can find out the age that the pullets are when they lay their first egg; and then the following fall, when these birds cease to lay, put down on your bird, with another leg band, the fact that they were laying or were not laying at a certain time in those same months, in the fall of the year. Now those months are September, October, November and December; and we have now come to the realization of what I believe is the most important clue to the hen's productive power, namely, the length of her laying period, determined by the knowledge of the date she laid her first egg and the date she laid her last egg in her first laying year. By that knowledge you can predict not only what a hen has laid during the year, with great accuracy, but you can predict what she is likely to lay in the next two or three years, under ordinary care. In other words, let me express it in this manner: you have heard the statement made over and over, "Tell me the company a man keeps and I will tell you who he is." "Tell me what a nation eats, and I will tell you who they are." Now we are going to paraphrase that and say, "Tell us the date that a pullet laid her first egg as a pullet and the date she laid her last egg in her pullet year, and we will tell you how many eggs she has laid that year, and how many eggs she is likely to lay if you keep her for several years."

It would not be safe for us to depend entirely on early laying as a guide in selecting our birds, because if we do so we include a good many birds that may have laid prematurely and will not be able to stand up under the heavy production for a period of years, and therefore we need to know when they cease to lay as well as when they commence to lay.

We have kept figures on some of our Cornell birds as to when they ceased laying, with the following results: of a group of 168 birds, 4 ceased to lay before July 1, and they laid 84 eggs; 17 ceased to lay by August 1, and they laid 96 eggs; 52 ceased before September 1, and they laid 117 eggs; 39 ceased before October 1, and laid 142 eggs; 39 ceased before November 1, and laid 166 eggs; 14 ceased before December 1, and laid 182 eggs; 3 ceased after December 1, and laid 189 eggs. Notice how many more eggs are laid by those groups that continue to lay late as compared to those that ceased early.

If a person had marked his birds so that he knew by putting a band on the left shank that these birds had all begun to lay as pullets, and had laid their first egg before they were eight months of age, he would have been able to keep the high-producing birds and discard the low producers. If he also knew, by marking his birds, those birds that laid some time after the first of September, he would have a choice group of birds, all indicated by the fact that they had a leg band on the left shank because they began by the time they were eight months old, the leg band on the right shank showing that they laid after September 1.

Birds can be classified into four groups, first, those birds that lay by the time they are eight months old and also continue to lay until after September 1, and so have leg bands on both shanks. The second group will be those birds that begin before they are eight months old, and they get a leg band on their left shank, but they cease to lay before September 1 and get no leg band on their right shank. Then we have a third group that are slow to begin to lay, and therefore do not get a leg band on the left shank, but do lay after September 1 and get one on the right shank. Then we have a fourth group of birds that do not begin to lay until after eight months and get no leg band on the left shank, and ceased to lay before September 1 and therefore have no band on the right shank.

By that method of selection we picked 81 birds out of 166 that had leg bands on both shanks, or 48 per cent of the flock; 44 birds that had leg bands on the left shank only, or 26 per cent; 13 that had leg bands on the right shank only, or 7.8 per cent; 28 birds that had no leg bands on, or 16.8 per cent. The first group's production was 166 eggs; second group, 122, — a difference of 44 eggs per hen for the group; the third group, 114 eggs; the fourth group, 90 eggs. In the second year the first group laid 140, the second group, 107, — a difference of 33 eggs; the third group, 129; the fourth group, 107. The record for the third year was 123 for the first group, 95 for the second, 114 for the third, 95 for the fourth group. The average production of three years was 143 for the first group, 108 for the second group, 119 for the third and 97 for the fourth.

And what did this mean in money value? It meant that the eggs sold at commercial prices for the first group averaged to sell for $3.57 per hen per year for three years; the second group, $2.40 per hen; the third group, $2.87 per hen; and the fourth group, $2.18 per hen. How is that for a contrast between the $2.18 and the $3.57 actual money value per bird for those years?

The first laying year for the first group comprised a 303 days' span between the first and last egg; the second group, 245 days'; the third group, 211; and the fourth group, 178. Notice the difference in the length of the laying period. So what would we have accomplished if we had, by this simple method of leg banding, been able to discard 28 birds at the end of the first year as birds that had an average production of 90 eggs the first year, 107 the second, and 95 the third, — an average of 97 eggs for the three years.

These birds were all culls, every one of them. Every one of them lost money for us if we kept them, and if we had wanted to we could have thrown all those birds out at the end of the first fall, or we could have kept them until early spring, when they ceased laying, and let them go at that time. We could have thrown away or could have sold as mere layers both of these groups, and we would not have lost any of our very high-producing birds, and we would have kept all, — practically all, — of our high-producing birds.

Now here comes the practical application of this thing to a color system of leg banding. I want to explain it to you in order that you may get the point clearly, and that is that we have first of all a record of the age of a bird, and then we have in the henhouse a statement when the birds in that house are six months old, when they are seven months, eight months, nine months old and so on. It is a very easy matter to figure out; you can do it in five minutes on the calendar. Knowing the date they were hatched, have hung right over each of those dates, nailed on, a certain leg band. Let each leg band be of different color; ordinary celluloid bands are used. Then mark those pullets as you see they are laying, either by trap nests or by means of external characteristics that you put on the shank of the bird. For the one that begins to lay before she is six months of age a blue leg band on the left shank; blue bands indicate best quality birds. Any bird that lays between six and seven months, put a red band on the same shank. Any bird that lays between seven and eight months, put a green leg band on the left shank, and on those that lay between eight and nine months put a yellow leg band on the left shank. After they are nine months old a person does not need to observe them any more; that will be somewhere around the 1st of January or the 1st of February, depending upon how early they were hatched. Any time a person goes into that pen and sees these birds running around he can see instantly what class they fall into by the color of the leg band, but he does not want to stop with that test, as you have seen from the statement and records given you, and I will show you why in a few minutes. Now, suppose he does that and he finds that 4 of them get blue, 71 get red, 50 get green, 22 get yellow and 19 get no bands at all, or perhaps black might be a good color for them, because that stands for mourning, meaning they have got to die, — practically no good. Suppose now we wait until the fall of the year, and if the pullets cease to lay by September 1 the chances are that they are not very good. Birds that began prematurely early to lay, and who ceased to lay a little before the 1st of September, get a yellow leg band on the right shank — a yellow leg band — because they ceased to lay before September 1. In the fall of the year we reverse the process, and the quality always goes with the length of the laying period, so that we begin by using the yellow band for those that ceased before September 1, the green band for those that ceased before October, the red before November and the blue before December. Then we have the birds with the leg bands on the right shank and the left, or with the left only and not the right, and it may be of one color or the other. So we can tell as the birds run around, after spring and fall testing, in which group they belong; and here you can see what the difference in the value of these birds is. Of the 71 birds 22 of them ceased before September 1, 18 between September and October, 22 between October and November and 9 after the 1st of November, making the 71. The birds with the blue leg band average 230, 195, 161, 171 eggs, even though they have been rather late layers, sometimes showing that the lateness which hens continue to lay is a more valuable indication of their productive power, even, than the earliness that they lay as pullets; and not only is this shown in the number of eggs that they lay, but also in the dollars' worth of eggs they lay, figuring up the egg values at the prices which are true here, no doubt, as they are in New York State, the wholesale price being 45 cents for January, 34 cents for February, 23 cents for March, 23 cents for April, 23 cents for May, 25 cents for June, 29 cents for July, 34 cents for August, etc. The values of the eggs of those early layers were $4.08; those that were hatched between six and seven months, $4.12; those that laid at seven to eight months, $4.29; those that laid between eight and nine months, $2.49; and the 19 birds that did not lay until after nine months, $1.93. Now coming clear over to the three-year record you will find that the birds that began early laid 145 eggs; those that began next, 125; then 123, 112 and 95, and the values of these eggs were $3.64, $3.34, $2.84, $2.15.

Now, suppose we make a rule that Leghorns hatched in the middle of April or early May, and which do not lay by the time they are eight months old, shall get a leg band on the left shank, and those that continue to lay after September 1 get a leg band on the right shank. After studying all these birds in all these different combinations we find that this is the one best rule to go by with Leghorns, and if you do that you will not lose very many good birds. Now, by doing that we found that out of 166 birds 81 of them fell into the class of having two leg bands, one on each shank; they began to lay before they were eight months old, and they continued to lay after September 1. Now, get their production, — 166 eggs. Eighty-one birds out of 166 average 166 eggs per year. Forty-four birds fall into the class of laying before eight months, but ceasing before September 1; they get a leg band only on the left shank. They laid 122 eggs as against 166. Thirteen birds fall into the class of beginning to lay after eight months, but continuing to lay after September 1. They get a leg band on the right shank only. See what they laid, — 114 eggs. Then there are 28 birds that get no leg bands; they began after eight months and they ceased before September 1; they had a very short laying period, so they get no leg bands. They averaged 90 eggs.

A MEMBER. I would like to ask you, Professor, in making this test if there was no mortality among those 166 birds?

Professor RICE. The records would naturally be comparable on the three-year basis. We could not include the record of birds that die. Some birds always die the first year or the second year, and we studied their records very carefully, and we find that as a rule they are likely to be perpetual producers, but occasionally a very low producer dies because of physical exhaustion.

A MEMBER. In making that test do you substitute another bird?

Professor RICE. No, we have never substituted another bird. We carried the same birds through always, and have not taken into consideration any bird that died in the meantime. It would not affect the principle in the least.

A MEMBER. Could these scores be made by physical tests?

Professor RICE. They could all be made by physical tests; as a matter of fact, however, it will pay to use trap nests, especially for persons who want to sell their eggs. For a farmer who is simply anxious to get results he can use physical tests, but to a poultryman who wants to sell eggs on absolute guarantee, and get high prices, it will pay him to put in trap nests and know absolutely the day that a hen began or ceased to lay.

I can only speak in passing of the importance in the quality of eggs in selecting our breeders, and a person can well afford to take the time to go over every egg that he uses for setting. Take a case of 30 dozen eggs and the chances are, if he uses the proper discrimination as to color, shape and size, he would find it a pretty difficult matter to get 50 eggs out of that case absolutely all right in every way. That is true of Leghorns, and I think true of every breed, and the importance of it is that the color pigment and color, shape and size are inherited characteristics, and we need to be exceedingly careful that we do not use an egg that we do not want perpetuated. One big loss is due to the necessity of having to throw out so many eggs that are not up to standard as to color or shape or size. If we can simply follow that practice, however, of using only the choicest eggs for breeding purposes, we will find our birds growing better and better, and we will see that every year our eggs will grade higher and higher. We have a number of people in our State who are doing this thing and have been doing it for many years, and the results are phenomenal in the improvement of the quality of the eggs. This is not a new thing to us at all. One year our extension men selected 29,000 hens for breeders. We have case after case in our State of men who will vouch for the fact that our men have gone into their flocks and picked out 200 or 300 hens, and they never got a laying hen out of the bunch, and these were sent off to market or put in other pens and kept there for a while. We have a case near by where Mr. Krum went up and picked some 200 or 300 birds out of about 700 or 800, and the man kept the balance, about 500 in all, the next year, and also carried over about 700 pullets, and that man tells us that he got a higher production the next year from those choice 500 hens that Mr. Krum picked out than he had gotten from the total population during the first year, and more than he got from his pullets. That means that by picking the hens out according to these tests, as I have showed you we could easily do, you can get rid of the non-producers and keep only producers.

As regards this matter of late moulting, I had the experience of speaking at a poultry association at Auburn two or three years ago, and after the lecture was over they said to me, "Come on out now, right into the farmyard and pick out the birds." Well, the farmyard was right there and that is just what we wanted to do, so we all went out together, and I picked out a dozen or 18 hens — this was in the latter part of September — every one of whom I knew was a bird who was laying about 175 or 200 eggs a year, and one of the men spoke up and said, "Why is it you are always picking out those dirty hens?" Well, as a matter of fact, I had not noticed that I was picking out the dirty hens. I was picking out hens that had not moulted; hens that had pale shanks; hens that had full crops; hens that had soft, velvety combs. I had not thought about the dirt on them, and the proprietor spoke up and said, "I can explain that to you. I put disinfectant in the nests — sprayed my nests with disinfectant only a week or so ago, and the only hens that are colored up as you see them here are the hens that are laying." So those high-producing hens, laying late into the fall, had this color or spray on their plumage, and they were the ones that had marked themselves. And you will find it will work out every time.

One of our young men down in New Jersey the other day at a poultry exhibition picked out the two highest Plymouth Rocks in an egg-laying contest, just by looking at them. Now, we are not guessing at this thing at all. Any man with his eyes open and who knows what he is looking at will be able to do that same thing, and do it with the most surprising accuracy.

POULTRY AND EGG PRODUCTION.[1]

HARRY R. LEWIS, POULTRY HUSBANDMAN, NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS.

It is with extreme pleasure that I have been able to meet with you at these sessions and receive some of the spirit of progress and co-operation which is so very apparent everywhere. I feel especially at home among you, for I not only have met many personal friends, but am, myself, a native of southern New England, having been born and reared on a large poultry and general farm in Rhode Island. While the conditions are somewhat different in New England than they are in New Jersey, yet a careful study of both has convinced me of the fact that the principles underlying the successful management of the flocks are the same. Any slight differences which may be necessary are of application, the method of applying the principle varying with the breed kept, climatic and market conditions. We have, as you know, in New Jersey a State which is noted for its large commercial egg farms, where White Leghorns predominate, and where the White-shelled egg for the New York market is the primary consideration. Here in New England, the larger, heavier, general-purpose breeds, useful for both meat and eggs, have by far the leading advantages. New England is especially fortunate in having not only suitable land and admirable climate, but also unlimited markets, and I firmly believe that with more attention to the farm poultry flocks, with better methods of production, the poultry industry of New England could be made one of its leading and most remunerative branches of agricultural effort. In order to accomplish this there are certain fundamental considerations which must be studied, and I would present the following to you for consideration.

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[1] From "Agriculture of Massachusetts," 1915.

I. KEEP PURE-BRED BIRDS OF A WELL-ESTABLISHED BREED.

We hear a great deal these days about utility *versus* fancy, which, analyzed, means the production of eggs and meat *versus* shape and plumage pattern. This agitation about the so-called utility possibilities has doubtless been brought about by the results secured at the egg-laying contests throughout the country, and also by some phenomenal records which have been made by some cross-bred birds. As a general statement it may be said that it is a mistake to attempt to produce eggs or poultry continuously from cross-bred stock. Considered over a period of years, birds which are continuously cross bred produce no characteristics which are not supplied by pure-bred individuals. Cross-bred birds show no reliability in breeding where egg production is the primary object. A larger egg production can be secured from typical egg breeds than can be secured from crosses of the egg and dual type. Where meat production is the object, larger returns both in quality and quantity can be secured where the pure-bred meat breeds are used. The use of standard bred birds, of a well-established variety, results in a uniform flock, both as to general appearance, size, shape and color, and the birds bring a more uniform price on the market than the mixed types. They cost no more to keep than a mongrel or a bird of mixed breed, for they consume no more feed nor do they require any more labor to care for them. Where pure-bred birds are kept, often considerable revenue can be secured from stock and eggs sold for breeding purposes. The additional revenue so secured is almost all clear profit. These factors should be given careful consideration before an attempt is made to produce eggs at a profit from a flock which has been promiscuously cross bred.

Constitutional or inherited vigor is, above everything else, necessary in order that the poultry flock shall succeed continuously. It is the experience of the author that where the stock is weak, poor hatches result, high mortality is common, low egg production and sick birds are the rule. On the other hand, where poultry farms have made marked success it can be traced in almost every instance to sturdy, rugged, healthy, vigorous stock. In discussing the stock there are a number of things to consider. Foremost is the determination of the breed best adapted to produce the type of product required. The birds themselves have frequently been likened to machines, which are required to transform the raw product — feed — into a finished product, — eggs and meat. Without a well-built machine this transformation cannot be carried on at a profit. There are many different types of birds, each designed for the production of a different type of product. The determination of the breed should be the first question decided. Three general classes of birds exist, first, the so-called egg or light breeds, most of which are of Mediterranean origin, of which the Leghorn is the typical example. These birds are kept in large numbers on successful farms where the production of white eggs for the wholesale markets is the primary object. It is an established fact that in New Jersey and New York these white-shelled eggs sell for from 3 to 15 cents more than brown eggs, the average premium being about 5 cents per dozen during the entire year. This difference is not apparent in Boston or southern New England. These light-egg breeds stand the confinement well and admit of herding together in large flocks. They are essentially active and are close feathered. Their rather large fleshy head parts require careful protection against freezing during severe weather in the winter.

The second type of bird may be called the general-purpose, and this includes the Wyandotte, the Rhode Island Reds and the Orpingtons. These breeds are characterized by their ability to lay a goodly number of brown-shelled eggs, and to bring in considerable revenue when sold for market purposes. It is this type of bird which is kept on some of the large commercial farms, but they more especially comprise the popular type on the farm and in the suburban communities. Being largely dual purposed they are the most desirable type for supplying home demands.

The third type of fowl comprises the meat breeds, of which the Brahma and Langshan are examples. These are the largest birds kept in flocks where market poultry products are the primary object, and especially where capons and roasters constitute the main marketable product. Recognizing these three distinct types, the breed should be selected which personally appeals to the poultryman, and which produces the best type or combination of products for his particular object or markets.

II. MAKE SPECIAL SELECTED MATINGS FOR BREEDING PURPOSES.

The aim of every poultry keeper, if he expects to remain in the business, should be to continuously build up his flock by breeding. Where the poultry and egg production is the primary object, the breeding efforts will be along two distinct lines. The first is to develop the most efficient egg machine which it is possible to breed. This means that his birds must be capable of turning out a maximum number of eggs of good quality during the winter season of high prices. This machine must be maintained at the minimum cost for feed and labor. The second object should be to develop a bird for table purposes, which will attain a sufficient weight in the shortest possible time, the flesh being of high quality and put on with the least expenditure for feed, thus securing the greatest possible margin of profit.

Paralleling these two aims in breeding should be the continuous effort to breed for vigor and stamina. I would that there were words in the English language which would enable one to express the great importance of vigorous stock. During the time that one is breeding for the so-called ability or commercial characteristics he should not lose sight of breed characteristics, and by selection and careful mating should improve his birds in respect to the body conformation which is required of that respective breed; and in order to maintain uniformity and an attractive appearance about the farm he should study to fix more permanently a uniform plumage pattern.

These results cannot be accomplished by promiscuous breeding, but they can be secured by continuous selection and the making of small special matings each year, following out a definite scheme of inbreeding and line breeding. A brief discussion of the most available method follows.

None will deny the fact that variations exist in birds, some good and some bad. The power of selection which the poultryman possesses is a wonderful instrument for improvement. The difference in birds is made possible by variation and by a continual selection of those which possess desirable qualities, and propagating these qualities into future individuals. A higher standard of efficiency in the progeny will thus continuously be secured. Careful attention to breeding accomplishes two definite things, — it increases the production of individuals, thereby making it possible to secure higher individual records, and it stimulates the average of the mass through the elimination of poor producers and the substitution of heavy layers in their place.

In order to be able to select and breed intelligently, the poultryman must know what his flock is doing. He must know the flock average in egg production. And what is of even greater importance, he must be willing to trap-nest a small percentage of his birds in order to learn individual performance. Unless he can determine the very best birds, selection and breeding with the idea of improving the average will accomplish little for lack of a basis of selection.

III. Hatch relatively early.

The time of year for hatching chicks which are to be reared as future pullets, or which are to be sold for broilers, should be carefully considered. A few weeks too early or a few weeks too late may mean the difference between a profitable winter production in the case of pullets, or in the case of broilers it may mean the difference between 30 and 50 cents a pound on the market. Late hatched pullets grow slowly during the summer, owing to the fact that they do not get a good start, and hence do not come into maturity in the proper time in the fall, and do not get under way in egg production before winter shuts down. On the other hand, if they are hatched too early, as, for example, early February and March, they will doubtless molt in the late fall, which will cause a lower production during the balance of the winter. The exact time for hatching will be determined largely by the type of bird kept. The American general-purpose breeds are characterized by slow

Quality in market eggs means more profit. (Courtesy of the New Jersey Agricultural Experiment Stations.)

growth, and hence must be hatched earlier than the light, active Mediterranean breeds which mature in from one month to six weeks' shorter time. The Leghorn and birds of their type are best hatched about the middle of April. Where it is necessary to bring off more than one hatch, they can be safely brought off from April 1 to May 15. This will give them between five and six months in which to mature, and thus be in laying condition by October. Heavier breeds will usually do better if hatched from the middle of March, and not later than the last of April.

The following are some of the more important advantages coming to the poultryman who tries February hatching: —

1. A considerable egg yield is secured during the late summer and fall, when the yearling hens are on strike, due to molt.
2. The eggs produced during these fall months bring high returns when sold for table purposes, due to scarcity.
3. The pullets may be profitably used to produce hatching eggs the following spring. A good number with strong germs and of good size is assured.
4. Cockerels which can later be used for breeding make good size and strong development early in the season.
5. The chicks will make an excellent growth before the hot, dry weather of summer comes on with its retarding effects.
6. Surplus cockerels will sell for high prices as broilers during the early spring.
7. The farmer will find early hatching profitable, as he can give them better care at this time than after the rush of spring planting begins.
8. To the commercial poultryman it lengthens his hatching season, and does not compel such intensive concentration as if all the pullets were brought off during one month.
9. The females reach maturity long before the intensely cold weather commences, which means greater vigor and better resistant powers.
10. A greater combined efficiency from all operations if the proper proportion of early hatched birds is kept.

Another factor which affects the time of hatching is the condition of the range upon which the chicks are reared and the method of feeding. Youngsters which are provided during the summer with an abundance of range, providing shade and green food and plenty of nutritious food material, will make a more rapid and uniform growth than flocks which are crowded into small bare yards during the same time.

The hatching egg should be carefully selected in order that it may be uniform in shape, size, and, as far as possible, in color; it should also be strictly fresh and of normal shell. If these characteristics are chosen, the tendency is for the progeny to lay a more uniform product.

Experience shows that eggs decrease in their hatching power the longer they are held, and it is never safe to hold hatching eggs over three weeks. When it is necessary to hold them for even a short time they should be placed in a moderately cool temperature, between 40 and 50 degrees being the most desirable. They should also be turned occasionally to keep the air cell from becoming misplaced. If possible, it is well to stand them on the end, leaving the air cell uppermost. The character and quality of the chicks resulting from the hatch will depend in large measure upon the condition of the hatching eggs placed in the machine. Too much care cannot be expended in keeping the eggs in a normal condition.

IV. PRACTICE CONSTANT SELECTION.

Selection should not only be continuously practiced in mating the breeding flocks, but it should be the plan to eliminate weak or sick birds throughout the brooding, rearing and adult periods whenever they appear. Fowls which show at any time a lack of inherent ability to resist disease are never a profitable animal on the farm.

Constitutional vigor, or, expressed differently, inherent vitality and stamina, is pictured by the perfect health, the activity and the vitality which is seen in strong fowls. Birds showing a lack of these are unsatisfactory, both as producers and reproducers. As we expect more and more of the modern hen in the way of production, fowls often break down, and the effect is especially shown in future progeny. Much of the low vitality and poor hatching quality in eggs, much of the weakness of the brooder chicks, much of the mortality and disease in adult stock can be traced to lowered vitality in ancestors, due in many cases to the immense requirements for production. The average hen is expected to lay in a year from four to five times her body weight in eggs. This means one egg approximately every third day of the year. In order to perform this feat of production she must consume approximately twenty-five to thirty times her body weight in feed. There is, doubtless, no farm animal which is more efficient as a transformer of the raw material into the finished product then the hen. The successful breeding for vigor means the appreciation of two sets of factors, — first, the lack of vitality, and second, signs in an individual which determine the presence or absence of vigor. Valuable work has been done by a number of our experiment stations in studying these factors.

The successful commercial poultryman and the farm poultry keeper who have studied their birds have learned that forcing, due to heavy feeding, or to intensive conditions, if continued year after year, cannot but, in the end, break down the physical strength of birds so treated. They have also observed that inbreeding for a number of generations, without regard for vigor in succeeding generations, intensifies the characteristics of low vitality which the original parents possessed. The use of pullets for breeding purposes, due to their immaturity, cannot but result in progeny of small size and possessed of less than their full quota of stamina. Forced feeding during the winter and fall, especially of concentrated protein feeds, has the immediate effect of taxing the digestive system, causing the bird to go off its feed and lowering its energy and physical strength. The continued crowding of breeding stock into poorly ventilated quarters, and the giving to them an insufficient amount of exercise, is another direct cause of low vitality. Such conditions will be apparent in the fertility and vitality as possessed by the germ in the hatching egg. Lack of care in hatching and improper range conditions for the growing stock are two other common causes of lack of vigor. Probably the greatest of all causes is the failure of the poultryman to select his breeding stock with great care. Breeding from nonvigorous birds means nonvigorous progeny, whereas the breeding from vigorous birds means vigorous progeny. When mating up the breeding pen, select male birds which show signs of physical strength and superiority; for example, the bird with a bright prominent eye, with a well-developed blocky body, with an erect carriage, glossy plumage and bright comb and wattles. The vigorous birds are usually active and spirited in their movements. They range extensively in search of forage. They will be seen to scratch energetically in search of feed. In a great many cases they are the last birds on the perch at night and the first birds off the perch in the morning. In the case of the male, the loudness and frequency of the crow is an indication of physical superiority, while the continual cackle and singing of the female has the same indication. It will be evident to any practical poultryman that there is a very definite and fixed relation which exists between the external appearance of fowls and their vitality; hence it should be the aim to systematically select for constitutional vigor at all ages and for all purposes.

V. Induce a Uniform, Rapid Growth.

A possible serious loss to the poultryman is death in the brooder. This loss can be, in large measure, avoided by selecting a suitable brooding system which will maintain proper environmental conditions, and in addition to this, by providing the chicks with a suitable feed ration. For the small poultryman, brooding only 200 or 300 chicks, the small outdoor brooder of 50 or 60 capacity may be satisfactory, but for the commercial poultry farm, or for the farm flock where 300 chicks and upwards are reared, the so-called colony brooder stove will be found very desirable. These are recent products, having been put on the market within the last two years. A great many different types are available. One which is substantially constructed and has a rather large metal reflector which can be raised and lowered, and which is provided with an accurate, simple method of regulating temperature, should be satisfactory. From 300 to 500 chicks (never over 500) can be placed under one of these hovers, and a brood of from 85 to 95 per cent. should be secured. The commercial plant doing considerable winter brooding, especially where winter broilers are produced, will find that an intensive brooder house, with a central heating plant and pipe running under the hovers, will have certain advantages. The colony brooders seem to be, at the present time, the same economical solution to the brooding problem. They should be placed in a relatively large house, never smaller than 12 by 14 feet, preferably of two rooms, one room containing the heater or hover, in which a fairly warm temperature is maintained, and an adjacent room in which the chicks can be fed and take their exercise. This colony system of brooding allows the chicks from the beginning considerable range, and cuts down the cost in permanent equipment and labor. It also enables the use of the house continuously throughout the year, for after the chicks have gotten old enough to do without heat, the stove can be removed and the house used for a colony house during the growing period, in which the pullets can be left until they attain maturity. During the winter the houses can be used for a short period for special breeding flocks.

The proper feeding of the artificially brooded chick is important, since the digestive system during the first four weeks is very delicate and easily upset by improper feed. The general practice should be to feed the chick the first few weeks of its growth without forcing, allowing to develop a vigorous constitution with a good body growth, and after that time it can better stand forcing for a rapid meat growth when desired.

When planning the rations for the youngsters, and when determining the method of feeding, it is important to appreciate that the first feeds should be easily seen and should contain much nutriment. It is also well to practice a restricted or retarded early feeding in order that their delicate digestive organs may not be overcrowded. Grit and shell are important essentials in the chick ration, and fresh water should be provided in large amount. Dry, cracked grains are safer, for the first few weeks at least, than wet mashes. Wheat bran is an important addition to the feeding practice, as it contains ash, is slightly laxative and is relished by the birds. Ash in the form of phosphoric acid can be secured in the form of dry ground bone, and is an essential element. During the early part of the feeding period the chicks should be fed little and often, and should be kept busy and hungry between feedings.

Sour milk in a loppered condition is very desirable, as it not only furnishes much food material, but the lactic acid present acts as an internal disinfectant. A continuous effort should be made to practice clean feeding, for nothing will upset the digestive system quicker than sour and moldy feed.

Hardening-off Process.

In order to get the chicks in condition for removal to the range it is necessary after the second week to practice a hardening-off process. This should be gradual and consist of lowering the temperature, with the idea of doing away with artificial heat entirely in from three to six weeks, depending upon outside weather conditions. The best practice is to reduce the artificial heat until it can be entirely given up, then gradually to raise the hover until it can be entirely open, and replace with muslin-covered frames, having them hung to the hover wall, gradually raising them in front a little each night until the chicks become used to their absence. It is impracticable to take them from a warm, heated brooder house and put them into a colony house unless they have been accustomed gradually to the change. The idea should be to get them on the range as soon as possible. When they are four weeks of age, the sooner they can be gotten out into the cool temperature in large, well-ventilated quarters, with free range, an abundance of green food and access to the ground, the better they will grow and the hardier and more vigorous will they be at maturity.

This hardening-off process is especially desirable with Leghorns, as their close feathering makes them susceptible to cold weather, and when not properly weaned they pile on top of one another to keep warm. This usually results in the death of many and a loss of vitality to the others.

After the chicks are weaned and placed on the range the aim should be to induce a continuous growth throughout the summer. Any checks or setbacks which they might be subjected to, due to improper feeding or care, will result in irregular maturity and lack of uniformity. There are two factors, aside from their inherited characteristics, which affect proper maturity. These are environmental conditions and food supply.

Environment plays an important part, as the best bred chicks, possessing all other desirable characteristics, if not given ideal conditions in which to grow will not exercise or develop to the fullest extent. These conditions are as follows: —

1. One should not attempt to grow young stock on restricted range.

2. Shade should be provided in abundance.

3. An abundance of green succulent food material is very necessary.

4. The type and size of the house in which the chicks are placed bears a close relation to their growth. Fresh air is the limiting factor.

The method of feeding the growing stock is not complicated. The practice should consist of having the food before them all the time, so that they can balance their own ration. They will usually take sufficient exercise if given plenty of range; hence the common practice is to feed a well-balanced dry mash in large, self-feeding hoppers, and supplement this mash with a good cracked grain ration. A complete dry mash should be used, it being always before them. In addition to this, a ration consisting of equal parts of cracked corn and whole wheat should be fed twice a day about the range.

This method of feeding will allow the chicks to balance their own rations, and will give the weaker ones a constant supply to which they can have access when they are crowded away at the grain-feeding time by the larger ones. Dry mash in self-feeding hoppers will tend to equalize growth and produce a more uniform flock at maturity, while the feeding of cracked grains entirely will tend to exaggerate and constantly increase any difference in size which may exist. Large self-feeding hoppers, holding from 200 to 300 pounds of mash, can be constructed and placed at frequent intervals around the range. This will facilitate the feeding and make the mash available at all times and to all chicks.

VI. PROVIDE A SUITABLE ENVIRONMENT.

The design of a poultry house and of its construction determines in large measure the environmental conditions which will surround the bird. The modern poultry house must provide all the features necessary to create ideal conditions, for no matter how well a flock of birds may be bred, if the poultry house is damp, drafty, cool and poorly lighted, disease and a decrease in vigor will surely result.

The following are the principles governing the design and construction of a suitable poultry house: —

(*a*) Dryness is fundamental in the poultry house.
(*b*) Plenty of sunlight needed.
(*c*) Importance of thorough ventilation.
(*d*) Give the birds plenty of floor space.
(*e*) Birds must be protected from an excessively cold temperature.
(*f*) The construction of the house must be rat proof and vermin proof.
(*g*) Economy in construction is a first-hand consideration in designing and building the laying house.

With these few words as to the principles of design, the following discussion of the New Jersey multiple unit laying house will give the details necessary to construct an efficient house possessing the features above mentioned.

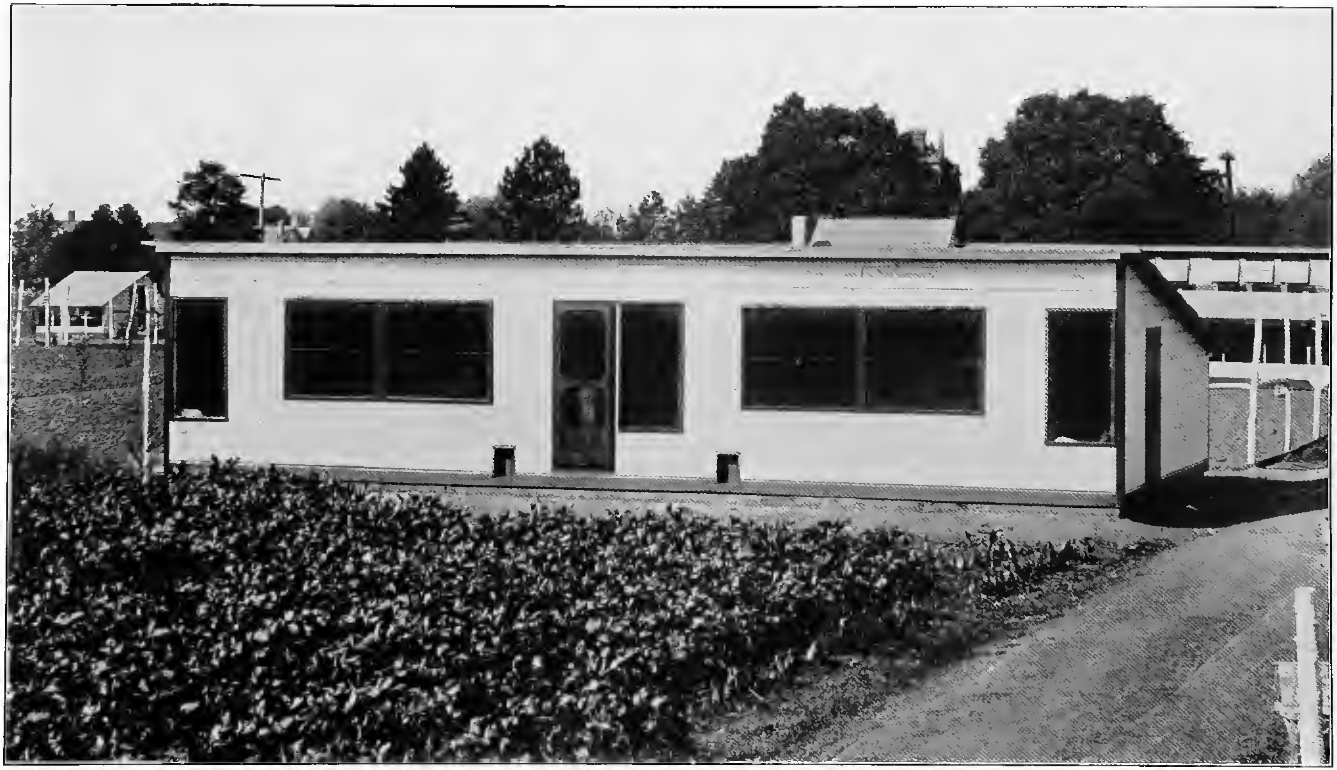
The New Jersey Multiple Unit Laying House.

The following plan of a shed-roof house, 20 by 40 feet, is especially suited to New Jersey poultry farms. Where it is desirable to keep larger units than a 40-foot house will accommodate, it is recommended that the length be doubled, making it 20 by 80, with three cross partitions (one every 20 feet), instead of only one, as in the 40-foot house.

The following description of the above plan shows the important features: —

The outside dimensions are 20 by 40 feet, sills to be 4 by 6, and to be bolted to a concrete foundation wall 8 inches wide, which is laid on tamped cinder or crushed stone, the entire depth of the foundation trench being 3 feet.

The shed-roof type of construction is used with 9-foot studding in front and 4½-foot studding in back. All studding and



The New Jersey multiple unit house. (Courtesy of the New Jersey Agricultural Experiment Stations.)

rafters are 2 by 4 hemlock or yellow pine. A 2 by 6 girder runs the length of the building supporting the rafters on concrete piers. The plates should be of 2 by 4 material doubled and joints broken.

All outside walls and roof should be single boarded, preferably of 8 or 6-inch tongued and grooved yellow pine; white pine can be used, but is much more expensive. The roof and back wall should be covered with a good roofing paper; all joints should be carefully lapped and cemented.

The muslin curtains in the front wall are hinged at the top and can be lifted up. The 3 by 5 glass is hinged at the side and open. One window in each pen should be so constructed that part of the wall will open when desired, thus making a combination door and window. This will greatly facilitate cleaning and filling hoppers, etc., in an extremely long house.

The dropping boards, perches and nests are best arranged on the back wall, the perches being hinged to the wall so that they may be hooked up when cleaning, the nests being darkened by a hinged door in front which may be let down when it is desired to remove the eggs.

The dividing partition between the units is built of boards, and extends from the back wall to within 6 feet of the front wall; the remaining space is left entirely open. This protects the birds from any drafts when on the roosts. When desired, portable light wire partitions may be used to separate the units. A large dry mash hopper should be built into this middle partition. If four or five units are built, it is only necessary to have a hopper in the center of each two units, the other dividing partition being utilized for nesting space. This hopper should be constructed with a wooden cover hinging at the center. There is a slatted elevated platform under the muslin front which provides room for the water fountain and grit and shell hoppers.

When the house is completed, a concrete floor should be laid, and should consist of three distinct layers. First comes a layer of about 6 to 10 inches of cinders or coarse gravel tamped thoroughly to serve for drainage purposes, to keep the soil moisture away from the bottom of the floor. Next comes a rough coat of concrete about 4 inches thick, and over this a finishing coat of two parts of sand to one of cement, troweled smooth and rounded at the corners. Where there is danger of much moisture between the rough and finished coat of cement, level it with a broom before the finish coat is laid.

Such a floor is moisture proof, rat proof, vermin proof and easily and quickly cleaned.

The following is a list of materials which will be required for building a double unit: —

List of Materials required and Approximate Cost.

Lumber: —
Sills, 6 pieces 4 by 6 by 20 feet, hemlock.
Plates, 8 pieces 2 by 4 by 20 feet, hemlock.
Posts, 2 pieces 4 by 4 by 14 feet, hemlock; 2 pieces 4 by 4 by 18 feet, hemlock.
Studding, 9 pieces 2 by 4 by 14 feet, hemlock; 4 pieces 2 by 4 by 14 feet, hemlock.
Rafters, 21 pieces 2 by 4 by 22 feet, hemlock.
Frames for nests and dropping boards, 5 pieces 2 by 3 by 16 feet, hemlock.
Eight-inch tongued and grooved yellow pine boards for roof, dropping boards, walls and nests, 2,200 square feet.
1 by 2 white pine for curtain frames and trim, 200 linear feet.
1 by 4 white pine for nests, 100 linear feet.
One bundle plaster lath for broody coop.
Nails: —
10 pounds 20 penny wire.
50 pounds 10 penny wire.
20 pounds 8 penny wire.

Approximate cost of the above,	$75 54
Roofing paper, 1,060 square feet, or 11 rolls at $3,	$33 00
Four special sash, 3 by 5 feet at $2,	8 00
Muslin, 8 square yards at 20 cents per yard,	1 60
Hardware, as hinges, locks, tacks, hooks, wire, etc.,	4 75
Foundation and floor: —	
Cement, 35 bags at 50 cents,	17 50
Cinders or gravel, 30 yards at $1,	30 00
Sand, 5 yards,	7 50
	$102 35
Total cost, not including labor if cement floor is put in the house and cinders and sand have to be purchased,	[1]$177 89

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[1] Costs of material for this house will of course vary in different localities and at different seasons. The above are prices current at New Brunswick, New Jersey, in January, 1916.

This gives a cost per square foot of floor space of $0.22.
A cost per running foot of house of $4.44.
A cost per bird, allowing 4 square feet per bird, of $0.888.
Adding labor to this at one-fourth the cost of material, the total cost is $222.36, or $1.11 per bird.

Environment is one of the great factors in production. The essentials of a suitable environment have been outlined. The importance of these factors cannot be too strongly stated. An appreciation of the fact that it is the healthy, contented, well-fed, singing hen that lays at a profit will do much towards insuring success from the beginning.

VII. PRACTICE AN EFFICIENT FEEDING PRACTICE.

The following is the New Jersey State dry mash with the supplemental rations which are designed for the complete feeding of laying hens throughout the winter. Such modifications as are necessary for summer feeding for different breeds are also described.

Dry Mash.

KIND OF FOOD.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Wheat bran,	200	380
Wheat middlings,	200	240
Ground oats,	100	100
Corn meal,	100	95
Gluten feed,	100	80
Alfalfa,	100	200
Meat scrap,	200	176
Total,	1,000	1,271

This mash should be kept before the birds all of the time in large self-feeding hoppers. During the molting season in the fall it is desirable to substitute oil meal for the gluten meal in the same proportion, to hasten the growth of feathers. As soon as the birds get on the green grass range the alfalfa can be gradually omitted and the meat scrap slightly reduced in amount. The extent to which the above mash can be cut during the summer will depend upon the character and amount of the range which is allowed the birds.

The mash as given is designed especially for the feeding of Leghorns; when heavier breeds are kept, such as Plymouth Rocks or Wyandottes, especially with yearling or two-year-old hens, the tendency will be for them to take on an excess of fat. Under such conditions it is the best policy to restrict the amount of mash eaten by leaving the hopper open during the afternoon only, thus inducing the birds to work during the morning hours for the cracked grain fed in the litter at the morning feeding.

As a supplemental ration to the dry mash the following grain rations are fed. A scratching ration of whole grain is fed every morning, both winter and summer, about 9 o'clock, in deep litter. Its primary object, aside from its nutritive value, is to induce the birds to take a considerable amount of exercise. About 5 pounds of this scratching ration is fed to each 100 birds on the floor of the house or under some shelter where the litter is dry and where there is protection from cold winds. The scratching ration is made up as follows: —

Scratching Ration.

KIND OF FOOD.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Wheat,	100	53
Oats,	100	98
Total,	200	151

At 4 to 5 o'clock in the afternoon, depending on the season, a night ration is fed, composed of whole and cracked grains, at the rate of 10 pounds to 100 birds.

Night Ration.

KIND OF FOOD.	Amount by Weight (Pounds).	Amount by Measure (Quarts).
Cracked corn,	200	120
Wheat,	100	53
Oats,	100	98
Buckwheat,	100	66
Total,	500	337

It will be noted that by feeding a night ration as outlined the materials are supplied to keep the bird's body warm during the night. The above ration is designed for Leghorns. When feeding heavier breeds it is desirable to eliminate one-half of the cracked corn and to substitute barley for buckwheat. During the summer months a night ration of equal parts of corn, wheat, oats and barley will supply all the needs for Leghorns. A good rule to follow in feeding the night ration is to give all the birds will eat, and then a little more, so that there will be some left for them to work on in the morning.

One great advantage of the dry-mash method of feeding is the fact that the birds are allowed to balance their individual rations in large measure, according to their particular tastes and requirements. The feeding of some succulent material in addition to the grain rations is very necessary for the best success.

VIII. MARKET THE PRODUCTS SYSTEMATICALLY.

Uniformity in all poultry products is essential. Color of egg, shell, size of eggs, size and weight of broilers and roasters are a few instances where uniformity means more returns.

The best of quality is none too good. The best always brings the highest price. Strictly fresh eggs, clean and carefully graded and packed, are always in demand. Infertile eggs for market are always in demand over fertile eggs. We must not be contented with getting a good production, but of equal importance is the necessity of getting good returns due to quality.

Mr. PIERSON of Amherst. I would like to ask if you gave your hens all the skim milk they wanted?

Professor LEWIS. Yes; if we gave the birds all the skim milk they could eat we would cut our meat scrap down one-half, making the meat scrap 10 instead of 20 per cent. If you can get skim milk, by all means give all you can to the laying hen.

Mr. PIERSON. Is it a stimulant?

Professor LEWIS. Not quite, but I would feed it if I had it. It has the lactic acid factor, which is a good internal disinfectant. I would prefer sour skim milk to any form of buttermilk I could get.

Mr. PIERSON. You don't get as much of lactic acid in the skim milk?

Professor LEWIS. No, but you get a high protein content which is very desirable; you get a lot of casein which you do not get in buttermilk.

Mr. H. G. WORTH. I would like to ask in feeding mature birds, why you feed cracked corn with your wheat instead of whole corn?

Professor LEWIS. Our idea in feeding our grain ration is to get exercise, as much as anything else. If we feed whole corn, a bird grabs a piece of whole corn and has got the equivalent of six or eight pieces of cracked corn, and it will fill our birds' crops up with much less exercise than cracked corn. Its food value is absolutely the same, but we are strong advocates of cracked corn for that one reason if no other. There are times when whole corn is desirable; in the winter, when it is very cold and we want to give the bird things that will fill it up quickly, we feed whole corn possibly, at noon; otherwise we feed cracked corn.

Mr. WORTH. Would not feeding the cracked corn be more expensive? Wouldn't there be particles of it that the bird would not get, and would not the bird get sufficient exercise in finding the corn without being fed with cracked corn?

Professor LEWIS. We always feed a sifted cracked corn, and there is probably no waste.

QUESTION. In regard to feeding snow, what have you to say in regard to letting poultry eat snow instead of water?

Professor LEWIS. It is our practice, and the practice throughout our section, never to let birds out, that we want to get egg production from, after the first snow falls in the fall, or after the ground gets frozen and muddy. Here is the proposition: birds going out and eating snow, or going out on cold, wet days, get chilled, and it is bound to reduce their production. The chilling seems to retard their reproductive functions and sets them back, and I should be strongly opposed to letting birds out where they could get snow in the winter when I was after egg production. With breeders, where I wanted a full amount of vigor, I would let them run out all winter.

Mr. J. W. SANBORN. What do you think is the best litter?

Professor Lewis. We use for litter, wheat or rye straw, primarily because it is coarser and does not grind up like oat straw. We grow quite a lot of our own litter, — buckwheat straw or oat straw, — harvesting it with the grain or throwing it directly in the pen and letting the birds thresh the grain out. I am an advocate of straw litter, supplemented if possible with shavings; that makes it drier and the shavings absorb the moisture from the droppings. I would say straw first and, if possible, a mixture of shavings.

Mr. Sanborn. How deep would it be safe to have it?

Professor Lewis. Eight or 10 inches. We usually start in the fall with it about 4 inches deep and add to it each week a little coarse litter. Keep the litter deep, coarse, dry and clean. If, due to certain conditions of moisture or a large number of birds closely confined, the litter gets dirty or finely ground, we do not hesitate to clean it out and put in fresh litter.

A Member. Do you use dropping boards?

Professor Lewis. Yes; although it takes a little labor to clean them off it maintains absolutely sanitary conditions, reduces any odor which might come from using dropping pits, and gives the birds the entire floor space. There is an important factor, — if we use pits there is too much floor space taken up. The capacity of the house is really determined by the number of square feet of floor space for the birds; therefore we get the perches up above the ground 3 or 4 feet, cleaning them off twice a week and putting on gypsum to keep them in good condition. Then we keep all the droppings and have a good income from those. We sell them in New Brunswick at $8 to $10 a ton to farmers who grow vegetables for the New York and New Jersey markets.

Mr. A. C. Hawkins. Do you advocate open-front houses in New England?

Professor Lewis. I advocate open-front houses in New Jersey and northern New York, and I know they have succeeded in Maine. I know also that your own professor of poultry husbandry at Amherst recommends them. In New Brunswick we had last winter a temperature of 14 degrees below zero, and 200 Leghorns, in an absolutely open-front house, where the house is dry, went through that cold snap without a frozen comb. Another flock of 100 Rocks and 100 Leghorns, in a house with a solid glass front, where the temperature in the house never went below zero, had their combs frozen and were put entirely out of condition on account of the increased moisture content due to lack of fresh air and ventilation. I believe that birds will stand a very cold temperature, providing the atmospheric conditions are dry. I believe you will find that the freezing of combs is not due so much to cold temperature as it is to cold temperature combined with dampness, or with dampness and poor ventilation, which means that the birds are of low vitality.

Mr. CARVER. Do you advocate feeding wet mash?

Professor LEWIS. No, except in one or two instances; it requires a good deal more labor, care and knowledge on the part of the feeder, and if that care and knowledge is not present it will put the birds out of condition. Dry mash will produce just as many eggs. There are one or two instances where a wet mash may be desirable, — for pullets coming in off the range in the fall and that have not grown very well, possibly a little wet mash, just crumbly, with a little ginger or saltpeter in it, may be desirable; and for yearlings that don't come back so well when the molt is over, a little wet mash with a little tonic in it may be desirable. A lot of our most successful poultrymen feed wet mash and get along with it very well. I am not condemning it, but it requires a personal application and knowledge of the birds and their appetite which few of us possess, and commercially or with a farm flock the same results can be secured with much less labor by the feeding of a dry mash.

Mr. E. C. BARBER. If we feed poultry six varieties of grain at one time they will always pick the corn first; is that a sign that it will do them the most good?

Professor LEWIS. No, I don't think so. We put some 30 grains and their by-products before a flock of 200 hens for a year; corn was the favorite and barley next. I think they need it, of course, to maintain themselves and provide heat and energy, but wheat is a more evenly balanced ration for poultry than corn, containing, as it does, considerable protein and not as much carbohydrates or fat. Corn is a very desirable feed; it is of a carbohydrate character but has a very small amount of protein, and you cannot make eggs from corn alone.

QUESTION. Would you tell me what is your opinion of feeding green corn, to chickens eight or ten weeks old, on the cob?

Professor LEWIS. I don't know that I ever fed any of it. I don't know why it would not be all right. It is succulent and palatable, and they would probably relish it as a part of their ration. It could not be substituted for dry mash or grains at all, because green corn is primarily a carrier of water, having 70 or 80 per cent of water present. I think there are other sources which would supply succulents in large quantities more economically.

Mr. HAWKINS. I would like to ask if there are any special characteristics by which we can select the hens that are the best layers by their general type and appearance?

Professor LEWIS. You saved me by putting on "appearance" at the end. There are certain factors which a number of investigators have brought to light recently which tend to be correlated with egg production. We have all said that the heavy producers, in the majority of cases, must have deep, long, wide bodies. I do not mean to say that every bird that has a deep, long, wide body is a heavy producer, but that practically all heavy producers have abundance of room in there, just as a good dairy cow has certain well-defined characteristics. There are other factors aside from that, definitely correlated with egg production. One is the color of the shank. Professor Rice has found that the heavy layers laid the color out of their shanks. A pullet will start out in the fall with bright yellow shanks; the color pigment in her shanks and her ear lobes will be utilized in going into egg production; by spring she will have pale shanks and ear lobes. The Connecticut station has done a lot of work on the color of the ear lobe of the cockerel as related to egg production, and there are other characteristics, such as the prominent eye and deep-seated head, which are indicative of vigor.

It is not such an awful proposition to take ten of the best hens picked by their external appearance and put them in a coop and trap-nest them during December, January and February. The birds that lay the most eggs during those months are almost invariably the ones that lay the most eggs during the year, and that is the type of bird you want to propagate. I believe it will pay anybody to separate four or five birds like that and get his wife or daughter or somebody to help him with the trap-nesting. It really only makes one extra trip in the morning, because in April, when they are laying heavily, you have got to visit them often. The only way we are going to improve our poultry and get definite improvements is by knowing what the individuals are doing. The poultryman has to come to it just as the dairymen have come to it.

Mr. H. B. Walter. Do you use a green feed for June and July for hens that are confined?

Professor Lewis. When we cannot get anything on the surrounding land to feed to them we practice double yardage; we have a yard, say, the size of this room, divided into two parts, and grow peas and oats on the first yard while the birds are feeding on wheat planted the fall before in the second yard. As soon as the oats get up 4 or 5 inches we turn the birds over into that yard and seed this other yard to buckwheat, and as soon as the buckwheat gets 4 or 5 inches tall we turn them over on to that and grow soy beans on the other yard. That gives us an admirable amount of green feed. When the soy beans get up 5 or 6 inches we turn the birds back into that yard and grow wheat. We practice in this way a crop rotation, and it does not take very long. We simply go in there with a fine-tooth cultivator, and all except the first seeding we plant broadcast, and as soon as it is high enough we put the birds in. It takes a very short time to do this, and it supplies those birds with green feed just as though they were on free range; and, what is even better, it maintains in those yards absolutely sanitary conditions. It turns under the droppings and uses their fertility to grow the crops with, and has maintained cleanly conditions, whereas otherwise those yards would have been absolutely bare and an undesirable feeding ground.

Question. About how much yard room have you for 100 hens?

Professor Lewis. We have there from virtually nothing up to free range. If I were putting up this house such as I described, I should want a yard for 100 hens at least 100 feet wide and 20 feet long, and practice double yarding as I have mentioned. Of course, I can grow other crops, like rape, which makes a very luxuriant growth. We grow a lot of rape for summer feeding to birds entirely confined. We have two flocks of 100 birds each which have never been out of the house for three years, and have made on an average $2.22 per bird. I am not recommending that, but am giving you an instance of the work we have been doing.

Question. Is there any danger of the rape making the eggs taste?

Professor Lewis. I have never had it do it, fed in moderate amounts, and we have fed birds right on it. I have heard of instances, however, where people claimed it had.

Mr. Parsons. Do I understand that you have tried keeping hens confined for three years as against free range?

Professor Lewis. Yes. The result of the free-range birds at the present time is about $1.98 in profit per year. The mortality has been nearly the same. The hatchability of the eggs of the confined birds has been very much below that of the eggs of the birds in the free range. Personally, my own opinion is this: birds which I was feeding for egg production I would keep more or less confined, except possibly during the summer when they were molting. My breeders I would let run as much as they wanted to and not force them for egg production, just previous to eggs for hatching. We have studied six or seven hundred eggs this last winter, with reference to their hatchability. We found that the dense albumen was apparent in all those cases where the eggs hatched, and there was 10 per cent less water than in the albumen of the eggs that did not hatch. We believe that a lot of poor hatching is due not to faulty incubation or faulty mating methods, but to the innate tendency of the bird to produce a watery albumen. There is not nutriment enough in that albumen to nourish the chick through twenty-one days and get it out of the shell. We are conducting some experiments on this line now, and expect to continue them during the coming year.

Question. Would you condemn introducing an English white Wyandotte cockerel for reproduction?

Professor Lewis. I hardly know what to say in answer to that. I would condemn it for this reason: the English white Wyandottes are not, in any sense of the word, white Wyandottes as I see them, — I want to be careful what I am saying, — and you are going to introduce into your strain of Wyandottes something entirely foreign to your particular breed, and I am afraid that the sum total of your results will be a good deal worse than if you let it alone. There are white Wyandottes bred according to the American standard which will lay just as many eggs as the English Wyandottes, and I believe you will get along better by finding in your own flock birds which are good producers and breeding from those. There is a possibility of doing a lot of harm by introducing these foreign types about which you know little, and furthermore, it is perfectly possible that you have in your own flock birds that are as good or better producers than the birds you are buying. I am convinced more and more of it, the more we get our poultrymen to use trap-nests. One of our big poultrymen, Charles Warner, has trap-nested 200 pullets, and he found birds that are absolute drones and birds that are laying over 200 eggs a year. All of you have got good hens, just as good as any hen, possibly, that ever made a record, and the thing is to find them, and after you find them, to use them intelligently, — get cockerels from them and use them in your breeding work. Every one of you here has got birds that are a great deal better than you think; find them, utilize them; that is the way Tom Barron got his birds, — finding out what were the good ones.

Question. Would you use the second crop of hay for feeding?

Professor Lewis. Yes, especially if it has clover or alfalfa in it. We go out into the haymow, sweep up the leaves and steam them for the poultry mash next winter, and if you have a lot of them it is a good practice to steam them and put them in troughs. A lot of those things you can use and find them of material advantage.

Mrs. Goodnough. When you have a pen of good Rhode

Island Reds, and have cockerels in that same hatch, would it be detrimental to inbreed for one year?

Professor LEWIS. No; if they were extra good birds I certainly should not object to inbreeding for one year. Inbreeding does this, — it intensifies any characteristic the birds possess by eliminating any foreign characteristic that any other strain of birds might possess. If those birds are good birds and have a good color pattern, good body shape and good egg production, and are free from serious defects, — crooked breasts or legs or undesirable features, — it is certainly desirable to breed them together; but if they are low in vitality, if they have knock-knees and things of that kind and you inbreed them, you are going to intensify the bad characteristics. Inbreeding intensifies good as well as bad characteristics, and we can inbreed for a number of years provided we use, in our inbreeding, only selected birds which measure up to a certain standard. We practiced a lot of inbreeding at the New Jersey station and got very desirable birds from it.

QUESTION. Is not early fall laying a sign of a good layer?

Professor LEWIS. Within certain limits, yes. I would not want a bird that came to maturity so early that it was dwarfed. When a bird comes to maturity — I mean by that, when it starts laying — it stops growing, and if it comes to maturity too early, it will always lay small eggs and will be more or less of a bantam style; but I would say that with Leghorns, five months, and with Rocks, six and a half months, is about the right time. It is true that birds that start laying in from five to six months are better than birds that don't start laying till they are eight or nine or ten months; it is an indication of continued high production for a bird to start laying about the time it should. April-hatched birds ought to be well along in production before cold weather commences in the fall.

POULTRY FEEDS AND METHODS OF FEEDING.[1]

JOHN C. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, MASSACHUSETTS AGRICULTURAL COLLEGE.

It is impossible to discuss intelligently the subjects of feeds and feeding, from both a practical and scientific point of view, without thoroughly understanding a number of important terms now in quite common use. We can hardly pick up a poultry journal or a book on this subject without coming in contact with such terms as protein, carbohydrates, fats, nutritive ratio, balanced ratio, etc. As there may be some readers who are not familiar with these terms, they will be defined in order that the discussions which follow may be fully understood.

Proteins are made up of the nitrogenous portions of feeds. They are the body builders, used in making the lean meat, eggs, hair, nerves, tendons, etc.

Carbohydrates are the starches and sugars particularly. These are used for energy and heat. A hen may eat a large amount of carbohydrates in twenty-four hours and yet at the end of the time, if she were killed and her flesh analyzed, we would find not more than 1 per cent of carbohydrates in her body, although her food has been composed largely of these materials. It shows how completely these are changed into other things.

Fats are the oily portions of food; they are also used in the body for heat and energy. The important thing about them is that they are worth for that purpose two and one-fourth times as much as the same weight of carbohydrates; that is, 1 pound of fats will produce as much heat and energy as 2¼ pounds of carbohydrates.

A balanced ration is one in which the amounts of protein, carbohydrates, fats and ash are in such proportions that when it is eaten by the hen there will be no waste of any one of these components.

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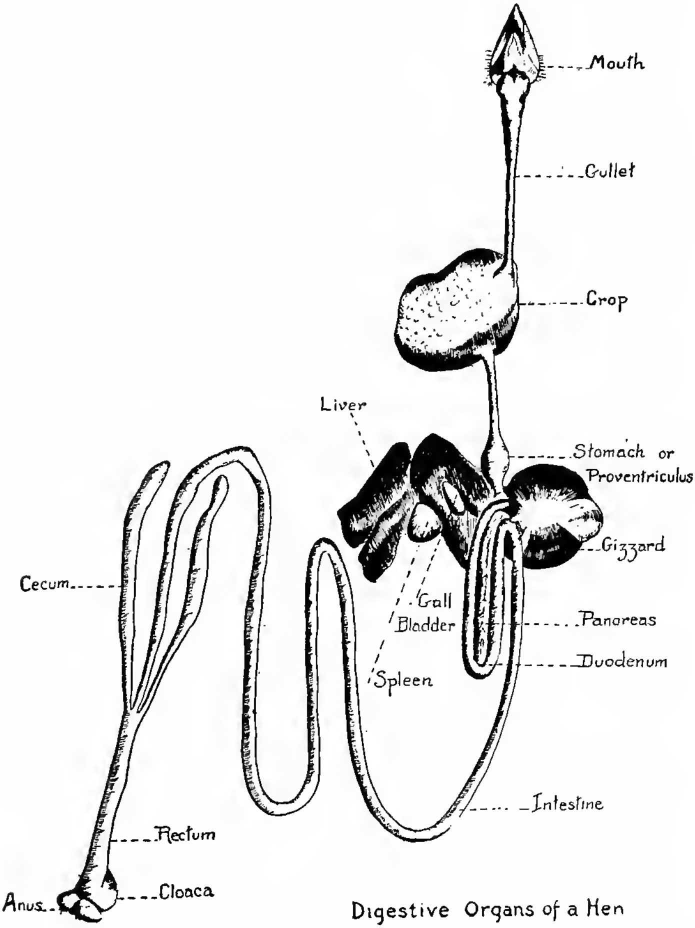
[1] From "Agriculture of Massachusetts," 1913.

Food principles, or food compounds, include protein, carbohydrates and fats.

The nutritive ratio is the ratio between the amount of digestible crude protein and the carbohydrates and fats in any given feed. It is found by multiplying the amount of digestible fats by $2\frac{1}{4}$, adding it to the digestible carbohydrates and dividing the sum by the amount of digestible protein.



Digestive Organs of a Hen

We should also have some knowledge of the digestive apparatus of the hen if we wish to thoroughly understand her needs. This plate represents the digestive organs extending from the head to the vent. They were removed from the hen a few weeks ago, placed in the position that we see them here and drawn. This plate does not show the relative position of the organs in the body, but it does represent their relative size. What is known as the gullet extends from the mouth to the crop, which is a reservoir for holding the food until it is softened more or less by the secretions of the mouth and of the crop itself. The crop is not the true stomach of the fowl, as many suppose. The true stomach is an enlargement of what might be termed the continuation of the gullet from the crop to the gizzard. Another term for it is the proventriculus. On opening it we find that its walls are quite thick and muscular, and lined with gastric glands similar to those in the lining of the human stomach. The gizzard is an irregularly shaped organ, the largest in the body, and has thick muscular walls of a very fine grain and of a bluish, dark red color. Partially enfolding the gizzard we find the liver, composed of two very large lobes. Attached to it is the gall bladder, where the bile is stored. Near it also is the spleen, an organ whose use we do not thoroughly understand, although some scientists believe it has some relation to digestion, as it is not found in the same condition just before and after meals.

The pancreas is the long, flat, pinkish organ lying close to the upper end of the intestines, or what is termed the duodenum. This secretes pancreatic juice. The intestines extend from the gizzard to the anus, about 6 or 7 inches from which we find two blind sacks called the ceca. They are sometimes spoken of as the "blind guts," and correspond to the appendix in man, but are double in the fowl. In diagnosing black head in turkeys, or coccidiosis as it is known in fowls, we find the ceca greatly enlarged, and many times their lining is eaten off, or they may be filled with a hard, cheesy substance. These organs seem to be the habitat for many intestinal worms, and if one is making a diagnosis for coccidiosis, or worms, he would naturally examine the ceca first. The part of the intestines extending from the ceca to the anus is called the rectum. The enlargement of the intestine just forward of the vent is called the cloaca. It is a reservoir where the fæces gather before being expelled from the body. The urinal duct opening into this reservoir is a very important factor in studying the digestibility of feeds in poultry. The fact that the urine and the fæces mix before being expelled makes it very difficult to study the digestion of protein, particularly because in the fæces we find the undigested portions of the feed and in the urine the nitrogenous materials that come from the broken-down cells of the body. As these mix before being expelled, it is very hard to determine how much of the nitrogen comes from the indigestible portions of the feed and how much from the urine. The entire length of the digestive apparatus of the hen is about 5 feet, varying somewhat in different individuals. Some think that there is a relation between its length and egg production, but more data will be needed to verify this theory.

The process of digestion is somewhat as follows: the food is swallowed by the hen and remains in the crop for a time to be softened. It then passes into the stomach, where it is mixed with gastric juice which acts upon certain portions of the food. From here it passes into the gizzard, where it is ground and thoroughly mixed with the gastric juice already mentioned. It then leaves the gizzard by way of the intestines, where it is mixed with bile from the liver and pancreatic juice from the pancreas. These are very powerful digestive juices, and most of the food is accordingly digested in the duodenum, or the first 12 to 18 inches of the intestines; but there is also an intestinal juice secreted by the lining of the intestines that acts upon the undigested portions of the food and completes digestion. The digestive apparatus of the goose or the duck differs from that of the hen in that there is no crop. The feed they eat remains in the gullet, which becomes more or less distended, until it passes through the stomach to the gizzard. This difference is probably due to the early habits of the birds. The geese and ducks, being water fowl, were able to eat food almost continually, whereas the original hen found it necessary to store up her food on account of her wandering habits. A thorough understanding of this subject will help us in the consideration of much of the data that will follow.

In our original studies of feeds and food principles, very little attention was paid to the value of the ash, or the mineral portions of feeds. It was thought that if we fed the right proportions of protein, carbohydrates and fats we were meeting all the requirements of the animal. However, more recent investigations and experiences have shown that many times animals do not do well because the food lacks mineral matter. Certain animals have been fed on ash-free food, and it was found that within a few days a decided change took place; the animal became weak, was unable to eat sufficient food, and if the experiment was continued for a few weeks it died.

In studying the needs of various classes of animals, naturally the milk of the mother formed the basis for investigation.

TABLE 1. — *Showing the Importance of Ash, Protein and P_2O_5 in the Feed for Growing Stock.*

	Days.	Lime.	P_2O_5	Ash.	Protein.	Sugar.
Woman,	180	.03	.05	.2	1.5	6.8
Mare,	60	.12	.13	.4	1.8	6.8
Cow,	47	.16	.20	.7	3.4	4.7
Ewe,	15	.25	.29	.8	6.7	4.2
Sow,	14	.25	.31	.8	7.2	4.5
Rabbit,	6	.89	.99	2.5	15.5	2.0

The foregoing is a very interesting chart on the analysis of milk of various animals. The first column gives the name of the mother. The second, the number of days after birth required for the young to double its weight. For example, the baby usually doubles its weight in one hundred and eighty days, the colt in sixty days, the calf in forty-seven days, and so on until we reach the rabbit, which doubles its weight in about six days. The third column gives the amount of lime in the milk of the mother. Notice that the amount of lime in the milk of these animals is inversely proportioned to the number of days required by the young to double their weight. The amount of lime in human milk, for instance, is one-thirtieth of that in the rabbit's milk; while the time required for the baby to double its weight is just thirty times greater than that for the rabbit.

Note that there are about equal amounts of lime and phosphoric acid in the milk of each, plenty of this material being provided.

In the next column we note the amount of protein in the milk of these various animals. We find the relative proportions are about the same as that of ash. The last column shows the amount of sugar in the milk. This is in inverse ratio to that of ash and protein, *i.e.*, we find more sugar in human milk and in the mare's milk than we do in that of the rabbit or sow. About the only way we can explain this difference is the fact that the rapid-growing animals, or those that double their weight in a very few days, need a large amount of ash for the framework and also a large amount of protein for building the tissues, whereas the sugar is needed principally for heat and energy, and is not so essential to the growth of the quick-growing animal as the other two, because protein, in case of necessity, can also be used for heat and energy.

As the chick doubles its weight in about twelve days under normal growth, it would come somewhere between the young rabbit and the pig. It therefore needs a large amount of ash and protein in its food.

It may seem to many unnecessary to dwell so long upon a matter of this kind, but there are hundreds of people who give their little chicks nothing but bread and cracked grain, or foods containing no more ash than these. The following chart illustrates the comparative ability of poultry and ruminants to digest some of our common grains: —

TABLE 2. — *Digestibility of Feeds. — Comparison of Hen with Ruminants.*

NAME OF FEED.	PROTEIN.		NITROGEN FREE EXTRACT.		FATS.	
	Hen.	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.
Bean,	71.7	77	46.0	71	37.0	63
Beef scrap,	92.6				95.0	
Barley,	77.0	70	85.0	92	67.8	89
Corn,	81.5	76	91.3	93	88.0	86
Oats,	71.3	77	90.0	77	87.8	89
Wheat,	75.0	74	87.0	93	53.0	71

Very little experimental work has been done with poultry on this subject, not because it is not important, but because of the physiological difficulty already mentioned, arising from the fact that the fæces and urine unite in the cloaca before being voided, which makes it very hard, indeed, to use poultry for digestion studies with satisfactory results. However, there are a few men who have attempted work along this line, and we think with considerable success. Among these are Dr. Woods of the Maine station, who obtained the results above shown. He used capons because of their inactive habits, and caught the fæces in a rubber bag attached to them with a sort of harness. His work shows that fowls are able to digest protein almost as well as cows can. Note how well they handle beef scrap and corn, but do only fairly well with oats, barley and wheat, and very poorly with bran.

TABLE 3. — *Digestibility of Feeds. — Comparison of Hen with Ruminants.*

NAME OF FEED.	PROTEIN.		NITROGEN FREE EXTRACT.		FATS.		FIBER.	
	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.	Hen.	Ruminant.	Hen.
Peas,	83	90.3	94	91.6	55	83.7	64	13.74
Buckwheat,	75	59.4	76	87.0	100	89.2	94	2.02
Wheat,	74	56.9	93	93.3	71	55.2		29.95
Barley,	85	79.2	86	89.1	87	68.3	60	

Here is another table giving data which have been taken from a European experiment. It shows that the hen can digest peas better than ruminants can. If this is reliable, there is no reason why cracked peas and pea meal should not form a part of the ration for fowls. Note also that they cannot digest the protein in our common grains as well as that contained in beef scrap, as shown in the preceding table.

The data given on the digestion of fiber afford very good evidence that the hen cannot digest this material as well as our other farm animals can. It is found, for instance, that the ruminants digest 94 per cent of the fiber in buckwheat, and the hen only about 2 per cent. Also the fiber in peas is hard for her to digest, notwithstanding the fact that she digests the other ingredients in them very well indeed.

TABLE 4. — *Digestibility of Fiber. — Comparison of Hen with Ruminants and Horse.*

NAME OF FEED.	FIBER.		
	Hen.	Ruminant.	Horse.
Rye,	2.4		31
Oats,	.5	31	35
Barley,	.2	50	

This is a chart comparing the digestion of fiber by the hen with that of ruminants and the horse. The data here are very similar to those given in regard to buckwheat and peas. Only about .5 of 1 per cent of the fiber in oats is digested by the hen, whereas from 30 to 35 per cent of it is digested by the horse and ruminants. And barley, another grain similar to oats, being covered with an indigestible husk, is very hard for hens to digest also. Only .2 of 1 per cent of the fiber is digested by the hen, while 50 per cent is digested by ruminants.

It appears from these various studies that, while the hen can handle carbohydrates in our common grains very well, the proteins and fats in them are digested only fairly well; and that while she can digest the protein in our animal products very well indeed, she is unable to digest very much fiber.

Therefore, in feeding, we should be careful not to overload our mashes, or rations, with so much of this fiber-laden material that the hen's digestive powers will be overtaxed.

TABLE 5. — *Amount of Droppings voided relative to Time of feeding Wet Mash.*

DATES.	Number of Days' Droppings.	MORNING MASH.		EVENING MASH.	
		Number of Hen Nights.	Weight of Droppings (Pounds).	Number of Hen Nights.	Weight of Droppings (Pounds.)
March 3,	1	22	3.00	21	6.00
March 5,	2	44	5.25	42	11.00
March 7,	2	44	5.25	42	10.50
March 10,	1	22	2.50	21	6.25
March 21,	1	22	2.50	19	4.50

The data of this chart were taken from Bulletin No. 122 of our own station, published a number of years ago but now out of print. This is the result of an experiment carried on by Dr. Brooks, and its object was to determine the difference in weight of droppings voided by hens fed at night on a wet mash and on a whole grain ration. The first column shows the dates; the second, the number of days' droppings gathered; the third, the number of hens on the roost, or, as the chart puts it, the number of hen nights, *i.e.*, on March 5 the droppings were left for two days, so the number of hens were doubled to give the number of hen nights. In the fourth column we find the weight of the droppings. Columns 5 and 6 contain data similar to those of 3 and 4, except that the hens in those pens were fed a wet mash in the evening, whereas the data in columns 3 and 4 are from pens containing hens fed mash in the morning and whole grains at night. It is seen that the weight of the droppings from birds fed wet mash in the morning is only about one-half of that from hens fed wet mash at night. This, it seems to me, is quite conclusive evidence that our ground grains, or mashes, are more quickly digested than the whole grains. This fact has considerable bearing upon the proportion of scratch feeds and mash to be fed to hens we wish to force. A forcing ration should consist of at least half ground grains by weight. If we want to make our ration still more forcing we should cause our hens to eat a still greater proportion of the ground grains.

The following chart shows the value of skim milk as a food, and its data were supplied by an experiment carried on at the Wisconsin Agricultural Experiment Station a few years ago. A sow weighing 23 pounds was placed in a pen in the month of May, where she could get nothing to eat except what was given her. She was fed wholly on skim milk for one year, at the end of which time she weighed about 406 pounds, and produced 10 pigs, the total weight of which at birth was 23 pounds. The sow and pigs were continued on the same ration, and when the latter were six weeks old they averaged 18.6 pounds apiece. We know of no experiment that has ever been carried on that shows more conclusively the value of skim milk as a food. It should be used for poultry when obtainable at 25 to 30 cents per hundred pounds. Better results will follow if it is soured before feeding, as the increased amount of lactic acid aids digestion.

TABLE 6. — *Value of Skim Milk as a Food for Animals.*

	Pounds.
Weight at beginning of experiment,	23.0
Weight one year later,	406.0
Weight of 10 pigs produced,	23.0
Average weight of pigs at six weeks of age,	18.6

CONCENTRATED FEEDS.

Just as concentrates have enabled the dairyman to develop the modern cow, so they have enabled us to develop the hen into the modern egg machine. Were we to feed poultry as it was done forty or fifty years ago, we would not get any more eggs than were produced then. At that time, on many farms, hens were not expected to lay except during the spring and early summer. The reason they laid in the spring so well was because of the green feed, worms, bugs, etc., that they were able to pick up. But concentrates, such as meat meal, gluten feed, oil meal, etc., have enabled us to feed the hen on rich protein foods throughout the year, and consequently we have the 200-egg hen.

In the great corn-growing section of the country the principal grain fed to poultry has naturally been corn, and because the use of corn as the entire ration for hens during the winter months resulted in a low egg production, it came into disrepute as a poultry feed, in spite of its actual good qualities. This caused both the Geneva Station, New York, and our own station to conduct a series of experiments on the value of corn for poultry, with the result of showing that properly used it is a most excellent feed.

TABLE 7. — *Feeding Values of Various Foodstuffs compared with Corn.*

NAME OF FEED.	Heat and Energy (Per Cent).	Value.	Price.
Corn meal,	100	$1 75	$1 75
Oats (ground),	83	1 45	1 85
Wheat,	92	1 61	2 00
Wheat middlings (flour),	98	1 71	1 65
Wheat middlings (standard),	67	1 17	1 55
Wheat bran,	67	99	1 45
Linseed meal,	94	1 64	1 75
Hominy meal,	105	1 82	1 65
Gluten meal,	91	1 59	1 70
Corn silage,	12	21	

This chart gives data worked out in part by Dr. J. B. Lindsey, of the Massachusetts Agricultural Experiment Station. The second column gives the heat and energy value of the various feeds or grains named in column 1, with corn meal taken as a standard; not, however, including the value of the protein in the grains for body building. Oats, it appears, are worth only 83 per cent and wheat 92 per cent as much as corn in producing heat and energy. Flour middlings as a heat producer almost equals corn, but standard middlings, which sell at only 10 cents per hundred less, are worth only about two-thirds as much as corn meal, yet many times during the year we pay more for standard middlings than for corn meal. Wheat bran, we find, is worth a little more than half as much as corn meal in producing heat and energy, yet we pay a great deal more for it at most seasons of the year. Hominy meal, which can be bought on the market most of the time, is, as a heat and energy producer, worth more than corn meal for feeding. The third column shows the actual value of these various feeds as compared with corn, and the last column shows the price paid for them this fall, about the middle of October. At that time we were paying $1.75 per hundred for corn meal and $1.85 per hundred for ground oats, yet the value of corn meal was 30 cents a hundred more than that of oats. We also paid $2 per hundred for wheat, but its actual feeding value compared with corn, as far as heat and energy are concerned, was 14 cents a hundred less. In the case of wheat middlings we find the value greater than the price paid by about 6 cents. Standard middlings and bran, according to these data, are worth very much less than we pay for them. Linseed meal was worth $1.75 per hundred at that time, and its heat and energy value was $1.64, but this particular feed contains a great deal of protein, the excess value of which, added to the $1.64, would make this a very economical feed.

The feed giving the best returns for our money, as shown by the table, is hominy meal, which could have been bought at that time for $1.65 per hundred, and its actual feeding value, compared with corn at $1.75, is $1.82. Notwithstanding the high price of corn at the present time, we should use it liberally in our ration, both in the mash and in the scratch feed. We also found in our digestion tables that corn was digested very well indeed by hens. Taking these two things into consideration, it is the very best grain we have for poultry. We should feed sparingly of standard middlings and wheat bran, although we use bran not so much for its food value as to lighten up the ration, and keep the food from packing in the crop.

Table 8. — *Rations for Heavy Laying Hens. — Digestible Nutrients needed per Day for Each 100 Pounds Live Weight.*

	Dry Matter (Pounds).	Ash (Pounds).	Protein (Pounds).	Carbohydrates (Pounds).	Fats (Pounds).	Fuel Value (Calories).	Nutritive Ratio.
Hens, 5 to 8 pounds,	3.30	.20	.65	2.25	.20	6,240	1:4.2
Hens, 3 to 5 pounds,	5.50	.30	1.00	3.75	.35	10,300	1:4.6

This is one of the most interesting and valuable tables that has ever been worked out on the subject of poultry feeding. It is well known among experienced and well-informed poultrymen that a balanced ration for hens should have a nutritive ratio of about 1 to 4½. Just how that was worked out may be interesting to many. Dr. H. J. Wheeler, formerly of the Geneva Experiment Station, performed an experiment to determine this along with some other facts, and secured these data.

Note that he worked with birds varying in size. Two pens contained hens weighing from 5 to 8 pounds, and two, hens weighing from 3 to 5 pounds. This table shows the amount of food each lot consumed per day for each 100 pounds of live weight. The experiment ran for a number of months, and what we have here is the average. The ratio between the amount of food consumed per day by the hens weighing from 5 to 8 pounds, as compared with those weighing from 3 to 5 pounds, is about the same for each of the food principles. One interesting fact brought out is that the small hens consumed nearly twice as much per 100 pounds of live weight as the larger hens. This is due undoubtedly to the larger number of eggs laid by the small hens, weight for weight, as there were perhaps 24 or 25 hens in the one pen and 15 or 16 in the other.

Another interesting fact is the ratio between the amount of ash and protein in the food consumed, which is about 1 to 3. This is doubly interesting because there is one particular mash on the market to-day that contains nearly twice as much ash as protein. It seems to me that poultrymen should think twice before they buy a mash that is loaded up so heavily with mineral matter.

But the main point in regard to these data is that the conclusion here reached, that the nutritive ratio of a balanced ration for a hen is about 1 to 4½, forms the basis for compounding our rations at the present time.

On account of many letters received asking information regarding the value of sprouted oats as a poultry food, we concluded to make an analysis of whole oats and of sprouted oats, to see whether there was a loss or gain through sprouting. A sample of whole oats was taken, and another sample from the same lot was sprouted in the usual way. When the sprouts were 1½ inches long a sample was analyzed and compared with the analysis of the original sample. The comparison is shown in this chart.

TABLE 9. — *Analysis of Whole Oats and Sprouted Oats (Per Cent).*

NAME OF INGREDIENT.	Whole Oats.	Sprouted Oats.
Protein,	15.05	15.24
Albuminoids,	13.81	12.22
Amides,	1.24	3.02
Fat,	8.80	8.91
Nitrogen free extract,	62.50	60.49
Fiber,	10.36	12.31
Ash,	3.29	3.05
Soluble sugars (dextrose),	1.33	5.78

It can be seen that the sprouting of these oats made very little difference in their nutritive value. There was a slight decrease in the amount of ash and a very perceptible increase in the amount of soluble sugars, *i.e.*, some of the starch in the oats was changed to sugar in the form of dextrose. That sprouted oats are very palatable is a well-known fact among poultrymen, and the changing of some of the starch to sugar no doubt accounts for this. We conclude, therefore, that the sprouting of oats does not decrease their actual nutritive value, and that we gain considerable in palatability and also in having a green food.[1]

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[1] Mr. Philip H. Smith, of the Massachusetts Agricultural Experiment Station, performed the chemical analysis.

There has been upon the market for the last few years a certain grit known as Hen-e-ta, for which great claims have been made by the company putting it out. In one of their circulars a statement was made that the eggs from hens fed Hen-e-ta contain twice as much phosphoric acid as ordinary eggs, and, therefore, hatch better. We decided to feed a lot of hens on oyster shell and another lot on Hen-e-ta, in order to test the claim by analyzing the eggs: Two pens of White Leghorns were selected and fed for about six weeks, one on oyster shell and the other on Hen-e-ta. In other respects their feed was the same. At the end of the period six eggs were selected from each pen and analyzed, with the following results: —

TABLE 10. — *Analysis of Eggs.*

	PER CENT OF PHOSPHORIC ACID (P_2O_5).	
	Oyster-Shell Eggs.	Hen-e-ta Eggs.
Egg shells, . . .	.33	.33
Whites of eggs, . . .	.32	.27
Yolks of eggs,	2.77	2.81

It would appear from this analysis that the whites of the eggs from the oyster-shell pen contained slightly more phosphoric acid than those from the Hen-e-ta pen, whereas the yolks of the eggs from the Hen-e-ta pen contained slightly more phosphoric acid than those from the oyster-shell pen. This slight apparent difference evidently lies within the radius of experimental error, so our conclusion naturally is that the feeding of Hen-e-ta rather than oyster shell makes no difference in the amount of phosphoric acid in the eggs.[1]

It would be much more convenient for the average poultryman were we to compound our rations on the basis of measure rather than of weight, because many poultry keepers either do not buy a large quantity of feed at a time, or, even though they do, they may not mix it all at the same time; many of them have no scales suitable for weighing grain, and are, therefore, obliged to measure out the different ingredients, and guess at the amounts corresponding to the weights desired. Especially is this true of the smaller poultry keepers. The reasons, however, why we base the amounts upon weight rather than measure in compounding rations are that all feeds, as a rule, are bought by weight, and also that measuring cannot be done accurately enough for scientific work. The following table is intended to aid those who find it convenient to compound their feeds by measure: —

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[1] Mr. H. D. Haskins, of the Massachusetts Agricultural Experiment Station, performed the chemical analysis.

TABLE 11. — *Equivalents of Weights and Measures.*

NAME OF FEED.	Quart.	Pound.	Pound.	Quart.
Alfalfa meal,	1	1.0	1	1.0
Corn, whole,	1	1.7	1	.6
Corn meal,	1	1.5	1	.7
Gluten feed,	1	1.3	1	.8
Linseed meal,	1	1.1	1	.9
Oats, whole,	1	1.0	1	1.0
Oats, ground,	1	.7	1	1.4
Wheat,	1	1.9	1	.5
Wheat bran,	1	.5	1	2.0
Wheat middlings,	1	1.2	1	.8

This chart, showing the equivalents of weight and measures of our most common poultry feeds, was prepared by Dr. Lindsey, with the exception of a very few items. The second column, giving the equivalents of 1 pound in terms of quarts, is the column that is of especial interest to the poultrymen who wish to do their mixing by measure. It, of course, makes no difference whether you use a quart measure, a peck measure, a bushel measure or a box, providing you use the same in measuring all of the ingredients. The table shows that if you wish, for example, to make a mixture containing equal parts by weight of corn meal, gluten feed, ground oats, wheat bran and wheat middlings, you will take about three-fourths of a quart of corn meal, three-fourths of a quart or a little more of gluten feed, nearly 1½ quarts of ground oats, 2 quarts of wheat bran and three-fourths of a quart or a little more of wheat middlings, in order to get the proper proportions by weight. In the same way one can make various mixtures by using the proper measure for each, and yet have the result based on weights.

TABLE 12. — *Chemical Components of Poultry, Eggs and Corn (Per Cent).*

	Water.	Ash.	Protein.	Fat.	Carbohydrates.
Composition of the hen,	55.8	3.8	21.6	17.0	
Composition of the egg,	65.7	12.2	11.4	8.9	
A very fat fowl,	41.6	3.7	19.4	33.9	
Composition of corn,	10.6	1.5	10.3	5.0	66.0

This chart shows the composition of an average hen, of the egg, of a very fat fowl and of corn. We see that corn fed alone — and the same is true of most of our other grains, generally speaking — is far from giving a balanced ration, but is a very one-sided feed. The hen, for instance, contains 3.8 per cent ash and the egg 12.2 per cent, whereas corn contains only 1.5 per cent ash. Again, the hen contains 21 per cent protein and the egg 11.4 per cent; the fat fowl 19.4 per cent and corn only 10.3 per cent.

The same is true of fats, as is seen when we compare the carbohydrates in corn with the fat in the hen and the egg.

The ratio of protein to carbohydrates in corn is about 1 to 9 in round numbers, so that if the hen which, under good laying condition, uses 4½ pounds of carbohydrates and fats to every pound of protein, is fed corn alone, she will be obliged to eat 9 pounds of carbohydrates and fats, or twice the amount she ought to consume in order to get a pound of protein. On the other hand, if we feed her too much protein in proportion to carbohydrates and fats she will be obliged to eat more protein than necessary. Whenever the hen must eat more of any one of the food principles than she really needs there not only is a waste of feed, but an extra strain is brought upon the digestive system to handle this excessive amount of food. We should see to it, therefore, that our hens have as nearly a balanced ration as possible, if we wish to be economical and keep the hen in the best condition.

A mixture of equal parts by weight of corn, wheat and oats has a nutritive ratio of about 1 to 8½. In order, therefore, to provide a balanced ration, we must feed something in addition to these grains that has a much larger percentage of protein. We have, therefore, adopted what we term the mash, a mixture of ground grains and by-products. By feeding such a mash, with a nutritive ratio of 1 to 2.3 to 1 to 3.6, together with about an equal amount of scratch feed, we place before the hen materials from which she can balance her own ration.

TABLE 13. — *Poultry Mashes.*

Mash 1.	Mash 2.	Mash 3.
200 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds alfalfa (ground). 50 pounds beef scrap. 50 pounds linseed meal. 50 pounds gluten meal.	100 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds fine ground oats. 100 pounds alfalfa (ground). 100 pounds beef scrap.	100 pounds wheat bran. 100 pounds wheat middlings. 100 pounds corn meal. 100 pounds ground oats. 100 pounds gluten feed. 100 pounds linseed meal. 100 pounds beef scrap.

We have in the above chart three different formulæ for poultry mashes, with some difference in their nutritive ratios, but all three well adapted to be fed with mixed grains. The last, or No. 3, is the richest in protein, its nutritive ratio being about 1 to 2.3.

TABLE 14. — *Scratch Feed Mixtures.*

First.	Second.	Third.
200 pounds cracked corn. 100 pounds wheat.	300 pounds cracksd corn. 200 pounds wheat.	200 pounds cracked corn. 100 pounds wheat. 100 pounds oats.

If you have barley or buckwheat, you can add 50 pounds of either, or 50 pounds of both, to any one of the above grain mixtures. The exact composition of a scratch feed should depend entirely upon the relative cost of the grains and the ease with which they can be obtained. As already noted, however, corn is the cheapest grain for poultry, and should form about one-half the scratch feed in any case.

Our method of feeding layers at the college is as follows: the dry mash is kept before the hens all the time. From 3.30 to 5 P.M., depending upon the time of the year, they are given scratch feed in the litter, about 50 per cent more than they will eat at once, so that they will have some left to work on in the morning while the attendants are watering and doing some of the other chores about the plant. In the morning, from 6 to 9, as the other work permits, they are fed more of the scratch feed; and this is all the feeding that is done under the dry-mash system. But since, as a rule, we wish to force our layers to the highest possible egg production, we also feed a wet mash once a day, about 2 P.M., which is a convenient time because it works in very well with the other duties of the attendant. The same formula is used for the wet mash as for the dry, but when we have no mangels, beets or cabbages we use cut alfalfa in the mash, making it compose about one-third of the bulk. Green or succulent food is given every day or every other day, in the form of cabbages, beets, mangels, turnips or carrots, which, as a rule, are split open and laid on the floor or in a trough for the hens to pick, though vegetables like carrots are usually run through a feed cutter and cut fine. Grit, oyster shell and water are kept before the hens constantly. Potassium permanganate, enough to give a good red color, is placed in the drinking water, especially in the fall, when the weather is very changeable and the hens and pullets are apt to take cold. It is a disinfectant, not a medicine, and a teaspoon level full is sufficient for 12 or 13 gallons of water.

The question is often asked how much to feed a flock of hens, 10, 20, 25, and so on. Those who have had experience know that this question cannot be answered definitely, as there are a large number of factors that govern the amount. The principal ones are as follows: the size of the hen; the activity of the hen; the number of eggs laid; ability to digest food; size of the eggs; kind of house; kind of treatment.

If any one will send us these data, we can answer the question fairly well, but without them it is impossible.

We know that hens eat about 50 per cent more in April, when they are laying heavily, than in November, when they are moulting. In a general way, 10 hens will need on the average about 1¼ quarts of grain and 1¼ quarts of the ordinary mash per day, or about 4 ounces of feed per hen. Results obtained by the New Jersey Experiment Station conform very closely with this estimate, and Dr. Wheeler in his experimental work with hens, already referred to, came to about the same conclusion.

TABLE 15. — *Amount of Food consumed, Average per Hen per Year.*

	Pounds.
Grain and mash,	90.0
Oyster shell,	4.0
Dry cracked bone,	2.4
Grit,	2.0
Charcoal,	2.4
Clover,	10.0

This chart shows the amount of food annually consumed per hen at the Maine station, and the data were based on the average consumption of 100 hens for a year. It appears that each hen consumed about 100 pounds of grain, mash and hay, or just about 4 ounces per day, — a showing which should be of value in determining the amount of feed required daily for a given flock of hens.

What I have said above refers to feeding layers. In feeding breeders I would not use the same methods by any means. As previously stated, the main object in feeding layers is to get the highest number of eggs possible for the amount of grain fed, so they should be pushed to the limit. On the other hand, we are feeding breeders for an entirely different object. We want to get from them not merely eggs to be used as human food, but eggs containing strong, vigorous germs that will hatch well, and not only live but grow rapidly to maturity. We therefore must feed especially for vigor. The breeders should be separated in the fall from the layers, kept by themselves, and fed on dry mash and whole and cracked grains, given in deep litter. We do not want them to lay too many eggs in the fall and early winter because we believe this saps their vitality to a certain extent before the breeding season is on. If they are eating too much mash or laying too many eggs it is well to close the mash hopper during the forenoon and leave it open only afternoons. This will cause them to work harder for the feed, and keep them in much better condition for the breeding season. They should not be fed an excessive amount of animal food, as it has been found to be detrimental to the hatching ability of the eggs and to the growth of the chicks. The best kind of animal food for breeders is skim milk or buttermilk, which can be fed in large quantities without injuring them in any way.

Table 16. — *Data showing Effect of Various Animal Feeds upon Percentage of Eggs hatched.*

Pen Number.	Animal Food used.	Whole Grain (Pounds).	Dry Mash (Pounds).	Animal Food (Pounds).	Total Cost.	Total Eggs laid.	Cost per Dozen Eggs (Cents).	Per Cent Eggs hatched.	Cost psr Chick (Csnts).
1	Buttermilk, ...	720	233	1,453	$18 16	2,040	10.68	55.0	1.61
2	10 per cent beef scrap in dry mash.	840	337	34	19 85	1,670	14.28	50.5	2.51
3	Beef scrap in hopper, . .	900	216	141½	22 21	1,664	15.84	33.0	4.00
4	No animal food, . . .	900	224		17 99	1,496	12.69	59.5	1.76
5	Green cut bone, . . .	900	196	127¼	21 37	1,654	15.48	40.5	3.18

This chart shows the results of an experiment carried on at Guelph, Canada, by Professor W. R. Graham, head of the poultry department at that station. The best results were obtained, on the whole, from feeding skim milk, and the poorest results from feeding green cut bone and beef scrap in a separate hopper. This experiment covered a period from October to March, and all of the eggs laid by each pen, which contained 23 hens, were incubated.

From this and data from other experiment stations it is evident that in feeding breeders we should not feed too much animal food, unless in the form of milk; and not push them for high egg production during the fall and early winter, but give them plenty of exercise, free range if possible, and all the green food they want.

Feeding the broody hen is something that is sadly neglected by a great many poultrymen. I have been surprised to find that there are some who starve them for a number of days in order to break them up. This seems cruel to me, and also an expensive way of doing it. The main object of the poultryman is to bring the broody hen to laying again in the shortest possible time, therefore she should be fed on very rich feeds, and even tempted in every way to eat. So treated, most broody hens will begin to lay again in from ten to fifteen days. A stimulating mash should be given to these hens, if to no others.

In feeding poultry, the main thing after all is not the feed, the hens or the house, but it is the man with the feed pail. Hens may be overfed or underfed; they may be fed the wrong thing at the right time, or the right thing at the wrong time. The important factor in this work is judgment, and this can be used only by those who have had experience and know chickens thoroughly. I have seen men walk through their houses, feed their hens and never look at them. I once accompanied a man of this type through his house, and when we reached the other end asked what was the trouble with the hens in a particular pen, having noticed they had roup. The feeder replied that he had not noticed anything wrong, except that the hens in that pen were not laying as many eggs as the others. These men are automatic feeders, and feed as a matter of routine. We do not believe that a man can be successful with poultry who cares for them in this way. He should watch the hens eat as he throws out the grain, see if they are hungry, stir up the litter to see if they have eaten all he has given them previously, etc. One man has put it very nicely by saying, "When you go out to feed your poultry take one pail of feed and two pails of judgment."

PRICES OF FEEDS AND POULTRY PRODUCTS IN YEARS 1898 AND 1913.

In periods of high cost of living, we are apt to think only of the prices of articles that we buy for food, and give no thought to the value of the raw material entering into those articles. For instance, we hear people speak of the high price of eggs, that the prices asked are beyond all reason, as they can remember a few years back when eggs cost only half as much as they do now. They naturally think that either the producer or the middleman is filling his pockets at the expense of the consumer.

TABLE 17. — *Relative Rise in Price of Feeds and Poultry Products, 1898 to 1913.*

Price of Feeds.

FEEDS.	WHOLESALE PRICE PER TON.	
	November, 1898.	November, 1913.
Corn meal,	$17 00	$32 50
Gluten feed,	17 00	30 00
Wheat middlings (flour),	17 00	32 00
Wheat bran,	16 00	25 50

Price of Poultry Products.

	WHOLESALE PRICE (CENTS).	
	November, 1898.	November, 1913.
Eggs,	26–28	59–60
Dressed poultry,	13–14	20–22

From this chart, showing a comparison between the price of feeds and poultry products for the years 1898 and 1913, we find that in 1898 corn meal was selling at $17 per ton and at present is $32.50; gluten feed, $17 and $30, respectively; wheat middlings, $17 and $32, and wheat bran, $16 and $25.50. The prices for 1898 were taken from a bulletin published that year at our agricultural college, and the 1913 prices were obtained from our local dealers on ton lots. It is evident from these figures that the prices have almost doubled in the last fifteen years.

In regard to the prices of eggs and dressed poultry, we found the following quoted in "Farm Poultry" for the month of November, 1898: —

Eggs (fresh),	26 to 28 cents per dozen.
Dressed poultry,	13 and 14 cents per pound.

For the year 1913 the following prices were obtained at the Boston markets, on the eighteenth day of last November: —

Eggs (fresh),	59 to 60 cents per dozen.
Poultry,	20 to 22 cents per pound.

From this it is seen that eggs have practically doubled in price in the last fifteen years, but that dressed poultry has not.

This comparison, on the whole, is not a very fair one, because we are taking the price of eggs when they are the highest of any period of the year, and poultry prices when they are the lowest, because at this time the market is flooded with all kinds of roasters, including hens, chickens, cocks, etc. This surplus is dumped upon the market for whatever it will bring.

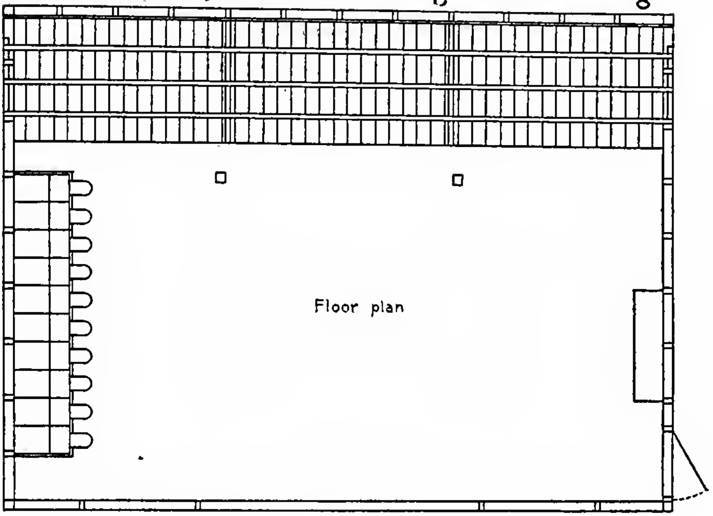
CHICKENS IN THE CORN FIELD.

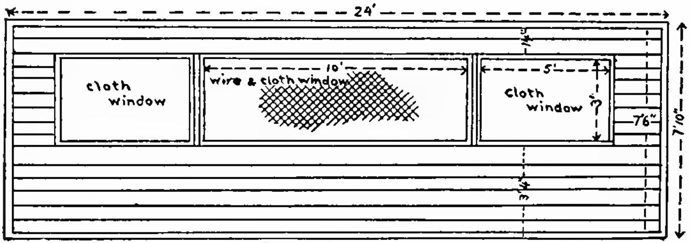
In husking and weighing the corn taken from one row across our patch at the college poultry plant this season, we found that the yield was 58 bushels per acre. We considered this an excellent showing, because corn was on the same ground last year, and the only fertilizer we used was about $1 worth of potash per acre. Poultry ran on the ground both last year and this. Furthermore, part of the land was cultivated only once during the season and the remainder only twice. Not a weed was to be found in the corn field at any time. The chicks were quite large when the corn was planted, and they were allowed to run on the land while it was coming up, but did not injure it at all, although some of them were about two months old at that time. There is no better place for raising chicks than in a corn field, as it not only furnishes feed for them but also shade, and the ground being cultivated, continually furnishes worms and bugs. The leaves of the corn act as a sieve and catch a great many bugs and insects from the air. These fall to the ground and are eaten. Moreover, the standing corn acts as a good wind break in the fall and fodder can be used for litter.

Any one who has land suitable for corn should by all means try to raise some in connection with the growing of young stock.

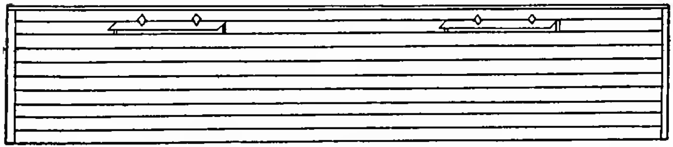
There has been considerable discussion as to the amount of poultry and eggs produced in this State annually, and also the amount consumed here. It is impossible to get at anything absolutely definite on the subject, but data secured by Dr. Brigham, author of "Progressive Poultry Culture," show that annually there are produced in Massachusetts about five million dollars' worth, while about twenty to thirty million dollars' worth are consumed. These data were secured several years ago, so at the present time we no doubt produce six million dollars' worth at least. An estimate of last year's consumption of poultry and eggs in Massachusetts, based upon the methods used in determining the amounts consumed in New York City, would give us about forty-seven million dollars' worth. Whether it is twenty-five, thirty or forty-seven million dollars' worth does not matter particularly, as the difference between production and consumption is great enough at any rate to assure us that the poultry business in Massachusetts is not overdone.

Plans of Poultry House at the Agricultural College

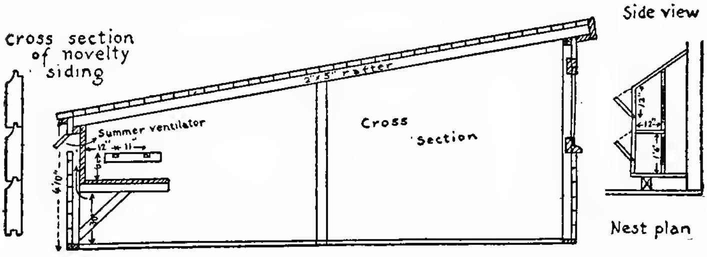




Front view



Rear view – showing ventilators



PRACTICAL POULTRY HOUSING.[1]

JOHN H. ROBINSON, EDITOR OF "FARM-POULTRY," BOSTON, MASSACHUSETTS.

At several of the farmers' institutes in this State which it has been my privilege to address during the past year, the description of some poultry houses I am using and explanation of reasons for using them have excited enough interest to make me think farmers throughout the State may be equally interested in this subject.

The ideas and principles upon which this method of housing poultry is based are not new, nor are they at all novel. On the contrary, they are very old and very common. The noteworthy thing among them is that they have not until within a few years seemed to those looking for the best ways of housing poultry to be worth serious consideration. For several years now they have been much discussed in the poultry press, and the general interest in them and increasing tendency to use them marks what is probably the last stage in the reaction from the plans and methods most in favor since the interest in better results from poultry culture began to assume its present importance.

For a great many years authorities on poultry keeping have advocated warm, tightly built poultry houses. They have held that, inasmuch as hens naturally laid best during the spring, the essential thing (if one wanted to get eggs in winter) was to reproduce spring conditions, especially temperature. So, with double and triple walls, with dead air spaces, with double sash on the windows, with large windows to admit as much sunlight as possible by day and with roosting rooms and closets to shut the fowls up close and keep them warm in at night, they have tried to approximate spring conditions. In a degree they have succeeded, as far as temperature is concerned, — that is to say, they have succeeded in maintaining a higher temperature in the poultry houses than is usually found in out buildings for live stock. They have protected the fowls from the extremes of winter weather.

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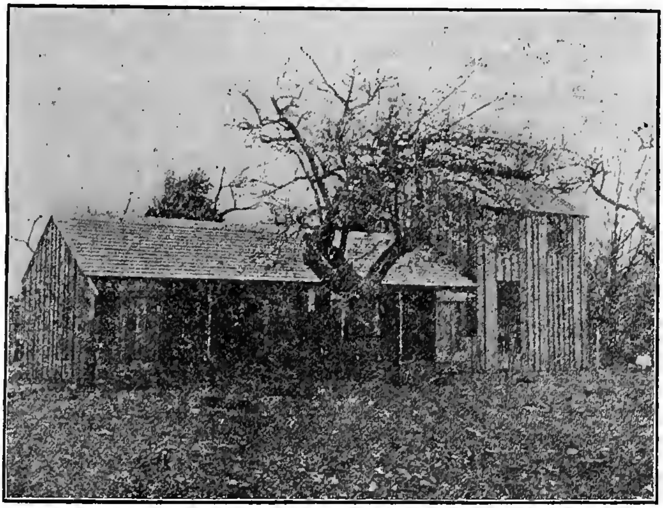
[1] From "Agriculture of Massachusetts," 1905.

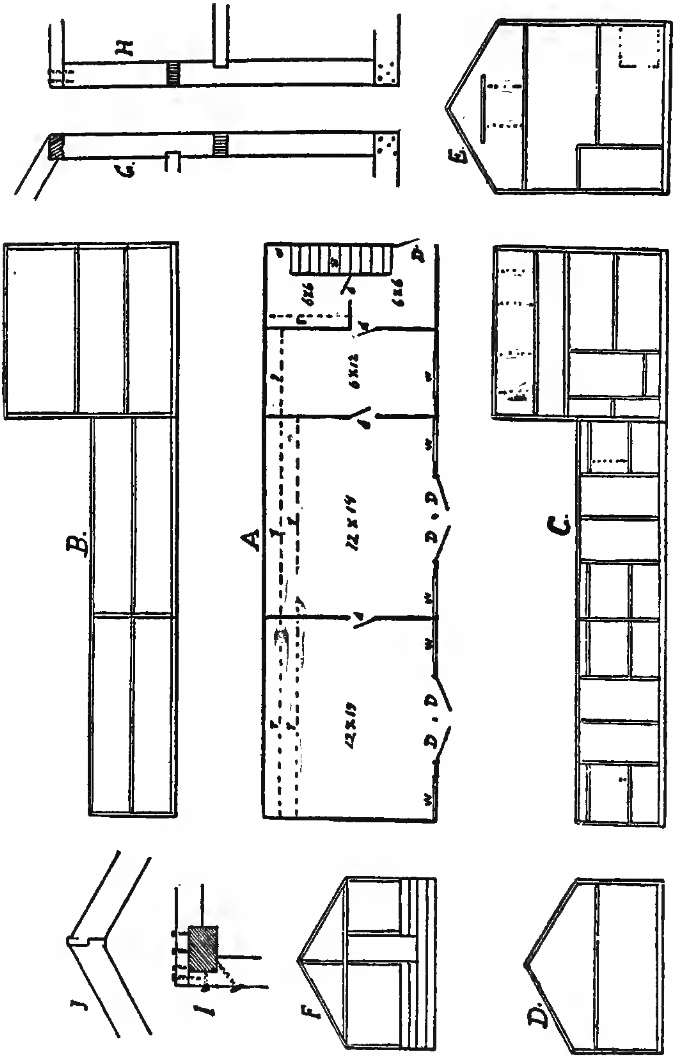
But the temperature is only a part of spring conditions. In spring and summer fowls have, with the higher temperatures, abundance of air in the houses, and live much out doors. The outdoor temperature and the temperature inside the houses are not much different. In the house it is cooler on a very warm day and warmer on a cool day, but the difference would rarely exceed 8 or 10 degrees either way.



Building used in J. H. Robinson's first cold poultry house experiment.

In winter, if the house is to be kept at a much higher temperature compared with the outdoor atmosphere than at other seasons, the house must be shut up, and there must be no free and rapid circulation of air between the exterior and interior, except when the outdoor temperature is high; for free circulation of air when the outer temperature is low will reduce the temperature in the house to within 8 or 10 degrees of the outside temperature, and if the outside temperature is zero, or 10 or more degrees below, this makes the inside colder than, on the theory that the house should be kept warm, is advisable.

To keep the temperature in the house up as high as required by this theory of housing, the house must either be kept shut



Plan of Poultry House used in J. H. Robinson's First Cold House Experiment. — This building consists of two parts, — a two-pen house 12 feet wide by 28 feet long, and a two-story part 12 feet square, with small pens on ground floor and room for pigeons, storage or other special use overhead. The low part is 6 feet high at the eaves, the other 12 feet. A, ground plan of house; D D, outside doors; dd, inside doors, ww, windows; rr, roosts, s, stair; B, outline of framework of rear wall; C, outline of frame of front wall; the dotted lines indicate the position of the windows; D, outline of frame of west end; E, outline of frame of east end; F, an inside partition between pens; G, framing of west end at corner post; H, framing of back at corner post; I, framing of posts and sills at corner; J, method of roof construction at peak, explained in the text.

so close that the heat from the fowls keeps up the temperature, or must be heated artificially.

Artificial heating in houses for laying stock has been tried many times, but generally discarded as unsatisfactory, and not giving returns to justify the expense. In central New York some of the large egg farmers who use S. C. White Leghorns to produce eggs for the New York city market keep stoves in their houses, but I know of nowhere else where it is generally done.

When a house is kept shut close enough to keep the temperature up by the heat from the fowls, proper ventilation becomes at times impossible. Under some conditions the house cannot be kept warm with the heat from this source, and at the same time the air in it renewed as often as it should be. When only the nights are cold, or occasionally there is a day so cool that it is thought best to keep the house shut up, no serious bad results develop; but when there are several days of continued cold weather, with the houses shut all the time, conditions inside the houses begin to be bad, and if — as sometimes happens — cold and stormy weather is prolonged for a week or more, conditions in the poultry house become very bad, the walls and under side of the roof drip with moisture, and the air becomes foul. Under such conditions roup often develops and becomes epidemic; or, where no virulent disease appears, the fowls are catarrhal, debilitated and unproductive.

It is often said that roup and kindred diseases were rare in old times, when most of the stock in the country was mongrel or old barnyard stock, and when all the attention the average poultryman gave to selection for breeding was to swap roosters every year; and many attribute the trouble to inbreeding, and to a greater liability to disease in thoroughbred fowls. I think it is due more to other causes, and as much to tight, badly ventilated houses as to any other cause, or perhaps to all other causes combined. Certain it is that in a great many instances in the last few years opening up the poultry houses and giving the fowls pure air in abundance by night as well as by day has been followed by a marked improvement in the general health of the flock.

My own experimenting with cold and open houses was undertaken to show what was possible under conditions quite the opposite of those generally recommended as necessary to good egg production and healthy stock in winter. I was constantly receiving inquiries from poultrymen having trouble with damp houses as to how to remedy that condition; and, as I visited poultry plants in winter, I almost always found the houses damp, badly ventilated, and overheated about midday even of quite cold days.

I think that in most cases conditions need not have been bad had the poultrymen used ordinary judgment in opening doors and windows. The common practice was to keep houses closed in winter except on very bright, warm days, and then either open them only for a little while in the middle of the day, or open them toward midday and leave them open until dark. Very often it would happen that houses were kept closed tight all day on a bright day, when the sun shone warm during the middle of the day and made the poultry house as warm as a greenhouse. Frequently the poultryman kept doors and windows shut nearly all the time, relying upon his ventilators to supply fresh air. That the ventilation did not work as it was theoretically supposed to work was generally plain to any one who stepped into the house, — except the owner. Where the intention was to ventilate by means of doors and windows, opening the house up gradually in the morning and gradually closing it in the afternoon, the system was rarely operated as planned. Such a plan, if faithfully put in practice, works well except for long-continued cold weather, when the short time the house may be opened is not long enough to thoroughly air and dry it; but I have seen very few plants on which this plan of ventilation was operated as it should be. On most plants it is attended to very irregularly, and often neglected for days while the poultryman's time is taken up with matters which seem of more pressing importance. Such a system of ventilating requires more time and attention than many poultrymen are able to give it; hence, is not for them a satisfactory system.

There was no guesswork or theory about my opinion that most poultry keepers would not give the ventilation of tight houses the attention necessary to make them satisfactory. Almost everywhere I went in winter I saw it, and found also that the worse conditions became in tight houses, the more afraid were the owners to let the air into them.

Various ways of preventing dampness in a tight house have been devised. Thick walls, double or triple, with air spaces or linings between, will not frost inside in cold weather as the single walls do. Some poultrymen make a loft of the space under the roof above the plates, and fill or partly fill it with hay or straw, which will absorb the moisture and keep the room dry.

Such devices, however, do not solve the problem of fresh air. It is practically impossible to keep a poultry house shut up so that the heat from the hens will keep it warm, and at the same time have the air in it renewed as it should be. If the building is large in proportion to the number of fowls kept in it, the heat from them has no appreciable effect on the temperature of it. If it is small enough to be kept warm by as many fowls as its floor space will accommodate, the air in it soon becomes vitiated. As I had occasion to look at the subjects of warmth and ventilation in the light of the experience of many different people, I began to think perhaps the prevailing ideas on those matters were not correct, and to ask myself whether it were not possible to get better conditions and satisfactory results in houses of a different kind.

To this question I found an answer that satisfied me in the large number of instances I could collect from memory, where as good results had been obtained in cold, poorly built houses as the average results in warm houses, and in the few instances where exceptionally good results had been obtained under conditions that we had been accustomed to regard as very bad. Such occurrences had, of course, been considered in the forming of the general authoritative opinion as to the requirements of winter poultry keeping, but were usually considered as exceptions that proved the rule, — a very convenient way of getting around facts that do not accord with theories.

But, however convincing the evidence a man may gather in this way may be to himself, it has not much weight with others; so, instead of publishing the results of my thoughts, I went to work, built a house that in several important features was quite contrary to the prevailing ideas of what a poultry house should be, and used it for nearly a year before saying anything publicly about it.

This house was a mere shell or shed; the walls were of common hemlock boards, laid perpendicularly on a light frame, and the joints between the boards covered on the back and ends of the house with common battens; the joints on the front were left open. The roof was of shingles, laid on strips of furring placed three inches apart.

The house was not tight anywhere. As I used it the first winter, — it having been built in a hurry late in the fall, — the battens were merely held in place with two or three small nails in each, and were loose enough to let a great deal of air in around them. The cracks in the boards, some quite large, were not covered at all. The front of the house had double doors 6 feet wide in each section, and these were kept open all day unless a storm would beat in, and all night except on very coldest nights or nights when storms would drive into the doors.

The house was built on wet ground; that is, ground that was thoroughly soaked by the late rains. After the roof was on, the ground in the house was spaded up; and when the house, a few days later, was ready to put the fowls in, the surface of the ground in it was dry, but a mere scratching of it would show damp earth. By spring there was about 2 inches of dry earth on top, and the soil damp below that. The walls in the house were dry, — never a bit of moisture on them except as a driving rain might wet through the joints and cracks. This would dry out quickly, and I never noticed any ill effects from it.

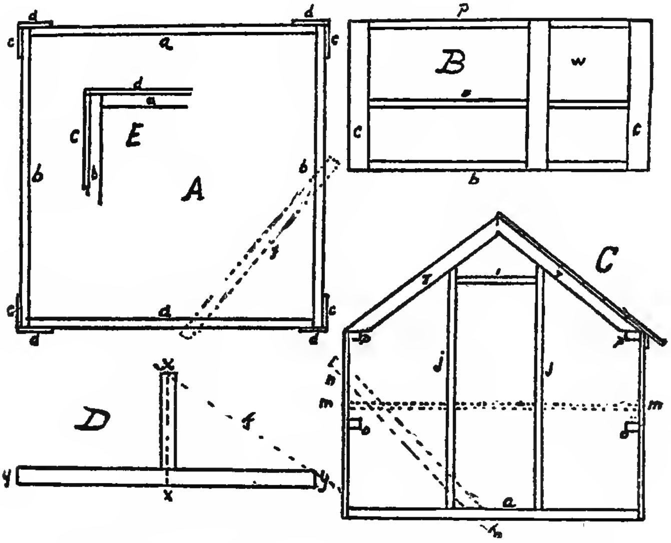
The house was cold, — the temperature in it was but little higher at any time than that outdoors; yet going into it I noticed that it always felt comfortable, with a feeling like what you get in a warm, sheltered spot outdoors, — not at all like the warmth of a heated building.

The hens always seemed as comfortable in it as I ever saw hens anywhere. There were some 50 to 60 in it that winter, and only two slight cases of colds, which recovered immediately with no treatment but a single application of vaseline to the head. The egg yield was fair, comparing favorably with average good reports. The hens in this house were Light Brahmas. I published a report of experience with this house, and on the strength of my experience with it began to urge correspondents who had much trouble with damp houses or unhealthy fowls to open up their houses, and keep them open at all seasons.

HOUSE IN WHICH LIGHT BRAHMA PULLETS WERE KEPT.

The next year I continued to use this house the same way, but put in a part of it a pen of Silver Dorkings, a breed reputed to be rather delicate and susceptible to cold, and having combs which would be more quickly affected by the frost. I also built another smaller house, on the same principle, and put in it a brood of late-hatched Brahma chickens. The Dorking male had his comb very badly frozen, but the hens' combs were scarcely nipped at all. They were put into the house December 1, began to lay in about three weeks, and laid well all winter.

The brood of chickens hatched June 27 that I put in the small house in October made a remarkable record for growth and early maturity. I got the first egg January 15, and by February 1 all the pullets, 9 in number, were laying; and from that time until February 22, when I took some out to put in my breeding pen, the 9 pullets were giving me about a 50 per cent egg yield, and still growing. I weighed them all on February 22, and found 5 of the 9 weighing 9½ pounds or over, and none of the others much below it. These pullets were not fat; they were big pullets, in good condition. Their house, as shown in one of the illustrations accompanying this article, was battened only on the back and half way forward on each side. The door was open practically all the time, day and night; and the windows were always partly open except when a storm came against one, when that one would be closed.



Details of Construction of House shown on page 139.—This house is 8 feet square on the ground, 4 feet high at sides, 7 feet in the middle. Cost about $12. A, sill plan, with position of corner boards indicated at c c c c, d d d d; E, construction of a corner; B, side; C, front; D, method of cutting pattern for rafters.

The next winter, still continuing to use the houses I had already built, I built on frozen ground late in November a house very similar to that in which the Brahma pullets just mentioned had been kept. It was made of old material, and was a little poorer in construction all around than the other house, joints between sides and roof not as good, and some very wide joints between boards in front. Into this house I put my Dorking hens and pullets. This winter, 1903–04, was, as all know, a record-breaker for cold and snow. Frequently after a night of driving storm I would go to this house and find so much snow sifted through the joints at the back that there was a light sprinkle of it all over the litter on the floor, — so much that the hens would not come down from the roost until the litter had been shaken up; and the backs of the hens as they sat on the roosts were well coated with snow. The tips of the hens' combs were somewhat frosted (no male was put in the house), but these hens gave me about a 40 per cent egg yield in January, 1904. There were very few hens in any kind of house anywhere doing better at that time.

During the several winters covered by the experiments mentioned my fowls were cared for by myself when at home, at other times by different members of the household, none of whom had any particular interest in or skill in feeding fowls. Our one rule for feeding was to be sure that the hens had an abundance. In the first half of the winter I had to be away so much that I found it impossible to keep accurate egg records. When I relied on others, they forgot; and so I gave up thought of making statistical figures complete, concluding that circumstances limited me to general demonstrations of a few leading facts, and the exact results possible in cold houses and comparison of these with results in other houses would have to be left to others. My trials demonstrated that hens could be kept healthy and giving average good egg yields in cold, open houses. So far as I could judge, they consumed no more food than when kept in warm houses, though theoretically it should have required more.

Last winter the only item of experience in my poultry yard having a further bearing on this subject was the performance of a pen of July-hatched Single-combed White Orpingtons. These were put in an old poultry house that was sheathed, papered and covered with common lapped siding on the sides and with shingles on the roof. The front of this house was about half glass, an immovable window, and there was a half window in each end, the door being at the northwest corner. The growth of an apple tree near the house had forced a board from the front next the roof, and there was an opening here the length of the house wide enough "to throw a cat through." The west window was wide open all winter. The pullets in this house had been sold early in January, and, as I was expecting to ship them any day, we kept no record of their laying. The buyer failed to take them; but, as I still intended to let them go, and as some weeks had passed with no records kept, we let them go along unrecorded. Through January, February and March these pullets, 9 in number, laid rarely less than 7 eggs a day, and often 9 for several days in succession. Nearly all their combs were somewhat frosted, and the comb of the male at one time quite badly frosted.

Now, of what use was it to demonstrate that warm houses are not essential to egg production, and that hens can be kept healthy and productive in very cold houses?

I went to the extreme, giving my fowls houses that were mere shelters, to show more convincingly, by extreme illustrations, that warm houses, which are more expensive to construct and require more careful attention to operate, were not absolutely essential. My tests, though not furnishing statistics, do show conclusively that egg production is not necessarily dependent upon "spring" conditions; and that the cold, open house for poultry is the style of house in which the labor of caring for them can be reduced to the minimum. Considered in connection with the general difficulties with tight buildings, they indicate also that the safest and most profitable and practical type of house for most poultry keepers is the house that is so constructed that it does not require close attention from the poultry keeper to keep conditions in it safe. They have not developed what is the best construction of house. It is reasonable to assume that a little better construction than I have used would be better, — would afford more protection, without making conditions that interfere with the steady renewal, in abundance, of supplies of fresh air.

Between the house so tightly built that the ventilation in it is very bad, and one so open that the temperature in it is but slightly higher than outdoors in extremest cold weather, there is a medium form of construction and an intermediate in methods of operation which will give more protection in the house without reducing too much the circulation of air in it. I think this medium form of construction must be much nearer the cold than the warm plan of housing; for when air is admitted freely, as it should be, the house cannot be kept very warm; and when the house cannot be kept warm, it is superfluous to make walls thick, and adds unnecessarily to the cost of construction. A wall of inch boards covered with a good building paper is as tight as if it were a foot thick. If a house is built with tight back, ends and roof, and has wide doors and good sized windows in front, and doors and windows are kept open as much as is necessary to prevent moisture from collecting on the walls and lower side of roof, the air will be good in that house, and the fowls healthy as far as health depends on good air. In a cold climate, such a house will be cold, — not as cold as outside, but still a cold house.

The special interest farmers have in this plan of housing fowls is in the demonstration it makes of the fact that there may be good egg production in a cold house; and that one need not despair of getting eggs in winter because his poultry houses are cold, or think that when he fails to get eggs in winter it is because his houses are cold. On most farms at present the poultry houses are of the class of those I use, and I find a great many farmers have been under the impression that it was useless to put forth special efforts to get winter eggs from poultry in such houses. The fact is that the house is not a matter of prime importance, except that in a warm, tight house that is kept shut up too much the hens are more likely to go out of condition and fail to lay than in a cold house; and, again, hens that do lay well in a warm house are apt to become debilitated and weak, and unfit for future usefulness either as layers or breeders.

The thing of first importance in the production of winter eggs is to have the fowls ready to lay about the beginning of winter; after that, the point of greatest importance is to feed well. These are the things without which you cannot get eggs until they are full grown. Old hens do not lay profitably until they have molted. Both pullets and hens in laying condition must have food enough to maintain themselves, and enough more to convert into eggs. In the spring a hen may produce eggs at the expense of her maintenance, but in fall and early winter she will not, as a rule.

The principle which the possibility of good results in cold houses and the successes and difficulties with hens in warm houses combine to establish is this: given hens in laying condition, and abundance of proper food, egg production depends on uniformity of conditions more than on high temperature.

Such uniformity of conditions is more easily secured in a house that is not much different in temperature from the outside air than in one that is kept much warmer than the outer air in extreme cold weather. In the open house the variations of temperature are less than in the house that is kept warm in coldest weather, unless the ventilation of the warm house is looked after much more closely than is customary. The open house does not need close attention. The fowls in it are hardened, — accustomed to a lower range of temperature than those in warm houses. Because of this, and because, breathing always pure air, their vitality and capacity to stand changes in the weather are greater, they are less affected by weather changes than fowls in closed houses.

To their better circulation and greater vitality also I attribute greater perfection of bodily functions, as seen in the greater fertility of the eggs from such fowls, and in the apparent fact that they get more nutriment from the food they eat. As I said a little while ago, I could never see that the fowls in the cold houses took any more food than fowls in warm houses. Since I began the experiments mentioned in this article a great many have been making observations along the same line, some independently of and without knowledge of what I was doing, and others because of the interest discussion of my tests excited. The general verdict of these is that no more food is consumed in the cold houses. Some say the fowls in the cold houses seem to eat less; a few affirm that they do eat less. Such statements seem at first thought improbable, yet they are not, on consideration, wholly unreasonable.

It is a fact which any one who has the opportunity and cares to take the trouble can easily demonstrate for himself, that dwarfed and stunted chickens eat as much as well-growing, hearty chickens of the same lots, yet hardly show any increase in size, while the others are growing rapidly. Long after the thrifty chickens have grown out of all comparison with the runts, if you separate them you may find the little runts eating much more in proportion to their size and rate of growth than the others, and often eating actually as much as the others. Why is it? Simply because digestion and assimilation are imperfect. The chick is ill nourished, not because it does not get enough or the proper variety of food but because its system does not do its work properly. Much of its food passes through it undigested. So with the fowl which breathes impure air. Its functions are sluggish. Its circulation is poor, as often shown in the chilled comb and the general air of listlessness. It is reasonable to suppose that digestion, too, is impaired, and the fowl gets less nourishment from a given quantity of food than it would if all functions of the body were in a higher state of activity. From this point of view, the observation that hens eat no more, and may eat less, in cold houses, seems worthy of some credit; and it begins to be doubtful whether there is actually, as theoretically there has been, an economy of food in using warm houses.

The strongest point that can be brought against the cold house for poultry is that it is not suitable for fowls with large combs and wattles easily affected by frost. This point has not so much weight with farmers in this State as in places where Leghorn and Minorca fowls are kept, because white eggs are wanted. Here most of the fowls on the farms are Plymouth Rocks, Wyandottes or Rhode Island Reds. The combs of the hens of these breeds are not easily affected by frost. Many of the male birds are almost as easily frosted as Leghorns. Where only a few males are needed they can be removed to warmer quarters on very cold nights; but with birds not intended for exhibition, or for sale for purposes where a frosted comb would count against them, I would let the comb freeze and the bird lose a part of it. It seems a cruel way, yet on the whole is more merciful; for, if the bird is properly taken care of after the comb is frosted, it does not seem to suffer much, the comb soon heals, the frosted tips drop off, and the bird is thereafter practically immune from frost bite, and the keeper does not have to give it special care.

I make the foregoing suggestion to those who have male birds with moderately large combs, and want to use cold houses. I would not advise it for fowls with very large combs, which if exposed would lose most of the comb. The best way is to keep fowls with small combs not easily frosted, or if one thinks he must have large-combed fowls, to select for breeders those least susceptible to frost. There is a great difference in individual birds in this respect. I have had Leghorn males with very large combs that were never frosted, though repeatedly exposed to temperatures at which other Leghorn males and many males with smaller combs were quite badly frostbitten. A few people using cold houses for Leghorns report that their Leghorns that have always been kept in such houses do not suffer as much from frosted combs as the same stock in closed houses. While I would not deny that they may be correct, it seems to me that conditions with them must be more moderate than in this section, or the houses were not as open as those I have been describing. As a matter of fact, large-combed males are a deal of trouble where the winters are cold, no matter what kind of a house is used; and practical poultry keepers, whether on farms or elsewhere, will find it to their advantage to breed for small combs. There is, I know, a very general belief that the largest combed hens are the best layers and the largest combed males the more vigorous sexually, and hence the most useful as breeders; but I think this impression erroneous. The best-laying Barred Rocks I ever owned had combs so small that the development of the comb as the pullets began to lay was often not noticeable. In Leghorns I have never found the size of the comb at all reliable as an index of laying capacity; my good layers of that breed have had large, medium and small combs, and I have found all degrees of productiveness in all kinds of comb but one. There is a type of comb most conspicuous in Leghorns and other large-combed fowls, but found in all classes of fowls but those having very small combs, that I believe is a sure index of lack of vitality. This is the undeveloped comb that goes with a peaked-looking head on a poorly developed bird. It is small to medium in size, and shrivelled in appearance. The small comb that still appears to be fully developed is the ideal comb for the fowls of the practical poultryman; and if he breeds for such combs on his fowls and for general hardiness, he will soon have stock of which both males and females are adapted to the cold house in practice.

I have gone thus at length into this matter of size of comb, because the fact that in a cold house in this climate the temperature will go lower than is safe for most large-combed males is the one serious objection to cold houses. The other objections cannot be maintained against a test, but the cold house is not a house for a male with an easily frosted comb.

The characteristic feature of the cold, thoroughly ventilated poultry house is not so much in the method of construction as in operation. By opening doors and windows any house can be made a cold poultry house. A good many houses built for warmth are now being used as cold houses. If the owners had to build over again they would build less expensively, for there is no need of making special efforts to have a building very warm, when the windows are to be always open.

The cold poultry house may be of almost any design or style desired, except that ventilation should be from the front of the house and the roosts at the rear; for the philosophy of cold housing is not to expose the fowls as much as possible, but to strike the degree of protection which is sufficient for the fowls and least trouble to the keeper.

With this article I give the plans of the houses I have described. These are houses that suit me for flocks of the numbers kept in each, and houses well adapted to farm poultry keeping. The small house, if made with close-fitting joints on the back and half way forward on the sides, is warm enough for the breed I keep, or for hens of the American breeds, Plymouth Rocks, Wyandottes and Rhode Island Reds. The larger house, unless in a very sheltered location, is better to be tight everywhere but in front, for it is a higher house, and the heat from the hens makes less impression in it. In the small house the heat from a dozen large hens has a very perceptible effect on the temperature, even in zero weather.

In conclusion, let me briefly enumerate the advantages of cold houses: —

1. Economy of construction.
2. Economy of time and relief from close attention to ventilation.
3. Healthier fowls.

The foregoing are the positive advantages. As to results, we may say: —

1. That, as a rule, the production of eggs will not be as good as in warm houses that are carefully operated, but will be better than in warm houses as commonly operated.
2. That whether the difference in egg production in a warm house can be made enough greater to pay for the better attention and the greater risks of disease as a result of any little slip in the system, is a question for each individual to determine for himself. Most farmers would determine in favor of the cold house, because it leaves them more free to look after other work.

A Final Caution.

The cold house, though it has advantages, is but a part of a system. I have made the point that the kind of house is not a matter of prime importance; that the essential things in the production of winter eggs are: —

1. To have pullets and hens ready to lay at the beginning of winter.
2. To feed them well.

The argument for the cold house rests on the proposition that uniformity of temperature and dryness in the house are the most favorable conditions for health and egg production, and that these are more surely secured by most people in cold houses than in warm ones.

The cold house is simply a condition for the hens, and a convenience for the poultry keeper.

CAPONS AND CAPONIZING.

HENRY D. SMITH.

The object in caponizing is to produce a large, full-breasted, meaty bird, to be used for roasting, as a rule, and of course only the larger breeds are used.

In those sections where the yellow meat is required the Light Brahma, Barred and White Plymouth Rocks are used mostly, and for the white meat it is usually the Orpington breed.

The old way of raising capons was to hatch out the chickens in the early spring, saving the pullets for layers, and caponizing the surplus cockerels and holding them until the next spring to be sold as roasters; but with the advent of the artificial methods of hatching and brooding it was found that by hatching them in the late summer, fall and early winter they weigh nearly as much when the prices are highest the following spring, with much less trouble and expense, and the meat is preferable to those that were kept until they were a year or more old, so that caponizing is practiced now, not so much to make what used to be known as a "capon," as to make a "large roaster chicken."

It is claimed by some that to caponize a cockerel will make him grow from 1 to 2 pounds more than he otherwise would have grown, and it is claimed by others that they do not grow any larger. Be that as it may, it is still very plain that "it is policy to caponize every male bird that is going to be sold as a roaster."

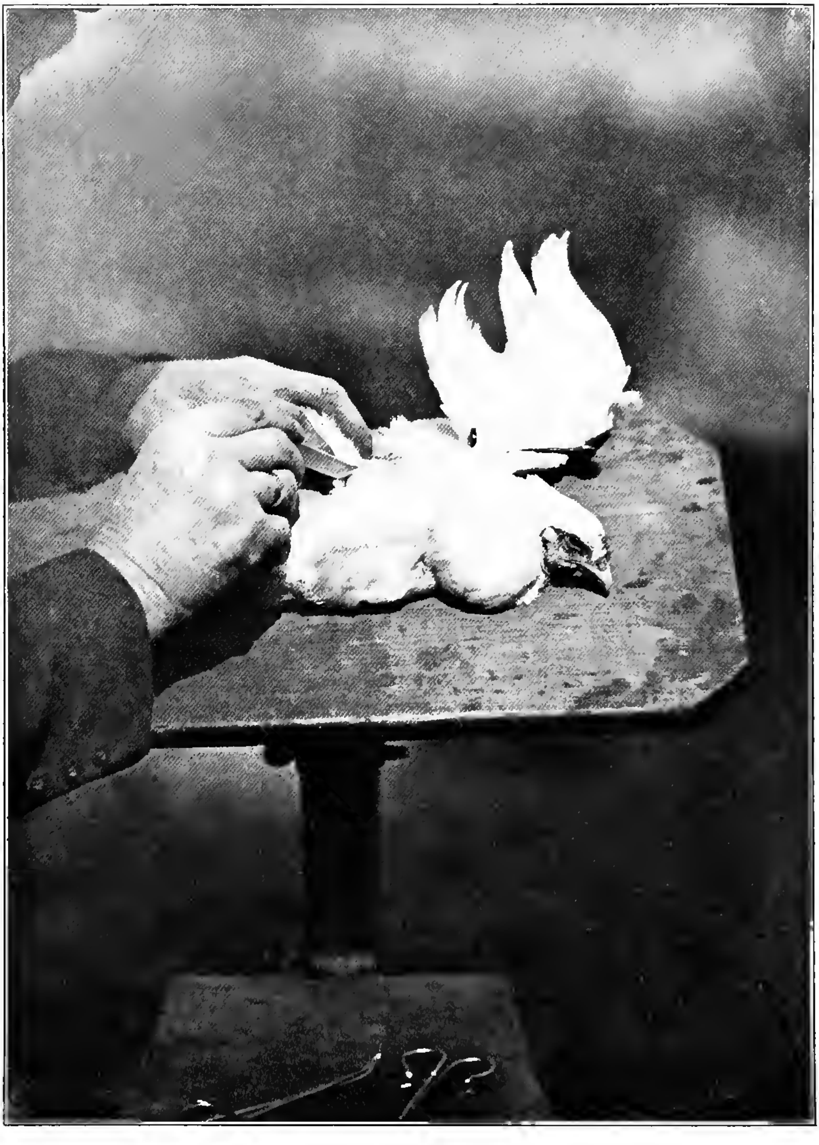
For instance, take a cockerel of the Plymouth Rock breed whose standard weight is 8 pounds. He will begin to crow and develop all of the male bird's characteristics at 6 pounds or under, at which time his comb and wattles get very large; then blood-red streaks form on his legs first, and then around the rectum, and later on around his neck; his breast ceases to be good and soft and to grow plump, so that his value as a good first-class roaster chicken begins to decrease, until if he is kept to the age of a cock bird he is worth about 8 cents per pound.

Now, let us caponize that bird, and when he gets to weigh the 8 pounds, the same as before, he is still good and soft, with his breast well rounded out and with good color, and the result is he is worth 32 cents per pound, live weight (May 8), or \$2.56.

To make the advisability of caponizing still plainer, here is a case that just came to my notice where a party tried the experiment of letting some 40-odd Barred Rock cockerels go without having them caponized, and the result was that the party who took them did not buy them outright, but had them dressed, and sold them to the best advantage he could and got 25 cents per pound for about one-third of them and 22 cents per pound for the other two-thirds, so that 18 cents per pound would have been a good price for them at live weight, when the price for good capons at that time was 28 cents per pound, live weight. They did not average quite 5½ pounds each, netting the owner a little less than \$1 apiece. Now this was some six weeks ago, and if those birds had been caponized they could have been held until now at a cost of 25 cents for feed, and they could readily have been made to weigh 7 pounds, and at 32 cents per pound would be \$2.24, making a good clean dollar's difference whether they were caponized or not.

During the fall and winter, when the prices are much lower, the difference is nowhere near as large as in the above case, and for various reasons. In the first place, the cockerels do not develop their male characteristics so young as in the spring, and the market is not so exacting, and the difference between the price of an old hen and almost anything for a chicken is but a few cents, anyway.

In selecting birds for caponizing take good healthy birds, weighing from 1½ to 2½ pounds, according to their degree of development. They should not crow or have much of a comb, so that their testicles will be only from one-half to three-quarters of an inch in length.



(Fig. 1.) Making the incision.

They should have nothing to eat all of the day previous to the operation, and until after they are operated upon, when they may be fed all they want and of their regular feed. It is not necessary to give them any special feed or soft mash because we have not troubled any of their digestive organs, — simply reduced their intestines so that they will not be in our way during the operation, and also to guard against their pushing the intestines out through the incision if they should happen to overexert themselves or otherwise; for they have no power to pull them back again, which means, if noticed in time, that they must be washed clean and the hole sewed up to prevent their coming out again, — all of which will not happen if they are properly fastened.

To make a table to hold the chicken on, take a board about 10 inches wide and 20 inches long and fasten on a piece of joist for an upright, sawed on a bevel, so that one end is toward the operator and the left side about 4 inches higher than the right side; then there are several ways to hold the bird, such as a half of a brick with a string about 2 feet long with a hook on the other end, and then take a turn around both wings, the wings being up over his back, and catch the hook on to the main string and then let the weight down, and the same arrangement can be used for the feet. The writer has a metal upright with hooks or catches on one edge and a wire with a ring in one end which is attached to an eyebolt that goes down through the board with a spring on the under side, so that when the wire is over the wings and caught on the hook upright the spring will adapt itself to the different-sized chickens.

With the bird secured on its left side (see Fig. 1), and the right leg pulled down a little the farthest, with the forefinger of the left hand pull the skin back tight, and, pressing down quite hard so as to press back the muscle that operates the leg also, draw the finger back until the finger nail slips off of the last rib, and, holding it there firmly, make an incision between the last two ribs from where they are joined together at the top to just below the bend in the ribs, making a curve to follow between the ribs, but do not cut the rib off, and make the incision about one-quarter to three-eighths of an inch deep;

then put in the spreaders, hooking on to each rib, and have the tension on the spreaders just sufficient to spread the ribs a little, and not enough to break the ribs on a small chicken.

Next, with the hook (see Fig. 2), tear a hole in the peritoneum, the thin membrane that covers the intestines, and if the bird is properly fasted the right testicle should be right in sight, but if not, push the intestines down away from the backbone, and it will be easily seen.

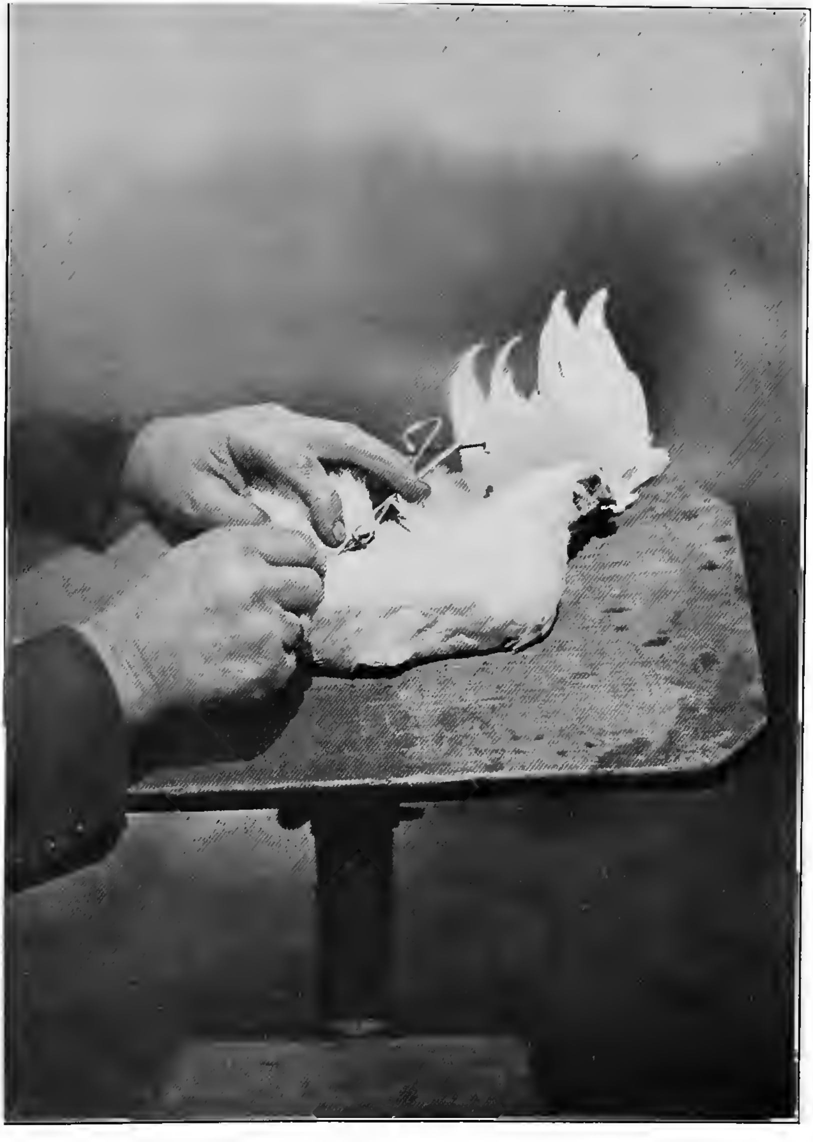
The left one is directly opposite, about one-half inch away according to the size of the bird, but just around out of sight.

Now with the Farmer Miles forceps, which works like a pair of scissors, having one side a flat plate and the other a wire loop, place the forefinger of the right hand in one finger ring, and the second finger in the other, and the thumb pressed down on the top one, having the flat plate down next to the intestines. Push the forceps way in beyond both of the testicles, open the forceps about one-quarter of an inch, and pull back, scraping the back of the bird quite hard, which will bring the left testicle out into view; then let it slip off of the wire loop, but catch it on the plate, and then shut the wire loop down back of the testicle. Pull back a little (see Fig. 3), then pinch it quite hard, and with a twisting motion pull it right out, bringing all of the spermatic cord that will come with it; then with the forceps open grasp the top one, and with the same motion pull that one out.

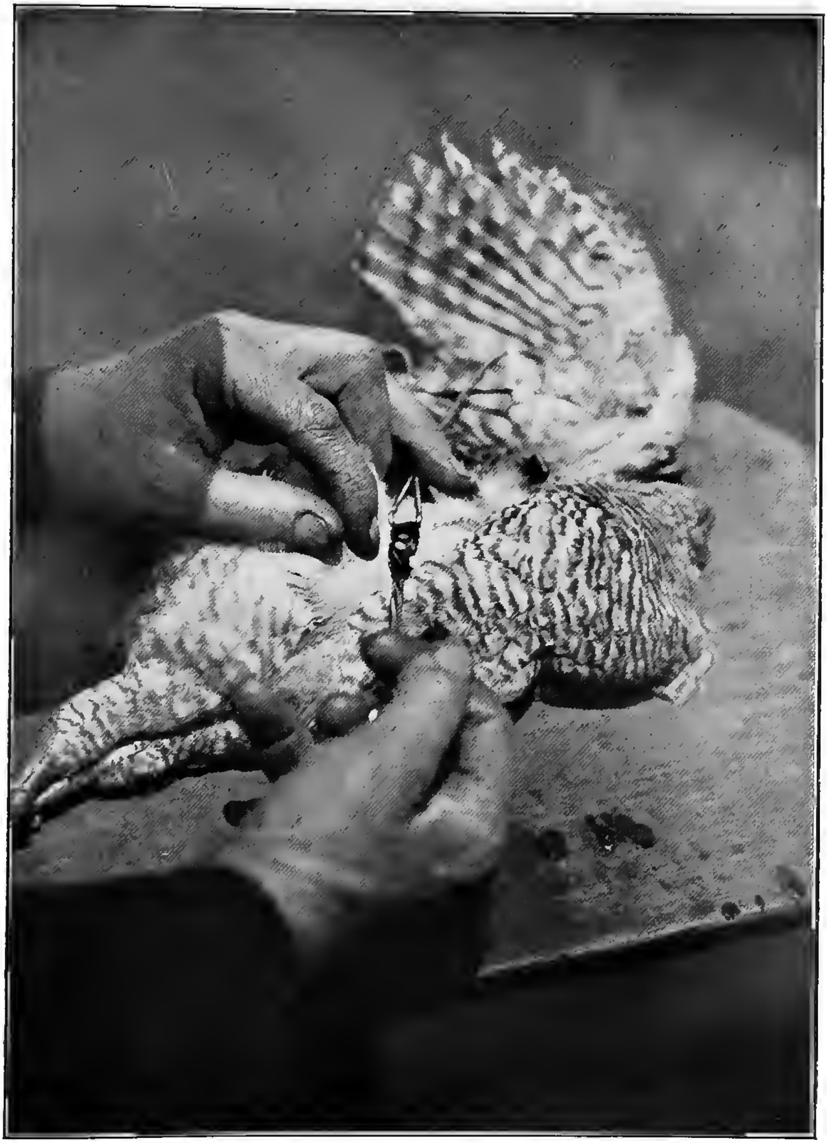
Be very careful not to pinch too hard before pulling back a little, or you may catch hold of the main artery, which lies between the two testicles; and rupture it, which means sure death.

It will be noticed that if the right leg was pulled down the longest, and the skin pulled back tight before the incision was made, when the bird resumes its natural position the hole through the skin will be way forward of the hole through between the ribs, which keeps the air, dirt, etc., from getting inside the bird, and a scab will form in a short time, so that in from three to four weeks' time it will be difficult to find the scar.

Occasionally, within a few days after the operation, a bird may puff up with gas, but as a rule it will pass off in a short



(Fig. 2.) Showing the spreaders in position and with the hook tearing the peritoneum.



(Fig. 3.) Showing both testicles, the upper or right one at the top, and the lower or left one at bottom, in the forceps, pulled part way out into view.

time; but if one is noticed that is very bad it will relieve them for a while to make a slit just through the skin and press the gas all out. If this is done it should be by making the slit as low down the leg as possible, so if any pus has formed it may run out.

The reader may think that from the time it takes to read the above directions it must take a long time to perform the operation, but such is not the case when one gets familiar with it, for the writer feels that he is going slow if he is not averaging 50 per hour, and has done 70 per hour for four hours running.

The best way to learn is to see some one do a few, and the next best way is to take a dead bird for the first one.

The death rate is very small, — much less than 1 per cent if the birds are the right size, are properly starved, are in good health, are done in a warm place, and it is seen that they do not catch cold immediately after the operation.

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